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(ZOOLOGY.)

Some Collections of the Littoral Marine Fauna of the Cape Verde Islands, made by Cyril Crossland, M.A., B.Sc., F.Z.S., in the Summer of 1904. —Bryozoa. By Arthur Wm. Waters, F.L.S., F.G.S.

(Plates 1–4, and 2 Text-figures.)

[Read 16th November, 1916.]

The collections, kindly submitted to me by Mr. Cyril Crossland, were made from Boa Vista, Cape Verde Islands (1); from underneath a coal-lighter in St. Vincent Harbour, marked (2); dredged, in 10 fathoms, in St. Vincent Harbour from a bottom of foraminiferous sand and nullipore nodules—also clinkers, &c. (3).

This communication completes the description of Crossland's tropical collections of Bryozoa. Two papers have been published by the Linnean Society on the Red Sea material, and two by the Zoological Society on that from British East Africa and Zanzibar. These last are referred to as "Bry. from Zanzibar."

Specialists have already described parts of the collections in the pages of this Journal and in those of the Zoological Society's 'Proceedings.' This Cape Verde collection was made with the aid of a grant from the Carnegie Trustees.

My plan, for a long time, has been practically to complete any paper by comparison of my own collections, and then to check my results in the

Natural History Museum, especially regarding types ; and I have again to thank Mr. Kirkpatrick for giving me facilities on these periodical visits.

The literature on the Bryozoa of the neighbouring seas includes :—

Smitt.—"Floridan Bryozoa," Kongl. Svenska Vetensk.-Akad. Handl. vols. x. & xi. 1872–73.

Busk.—"On some Madeiran Polyzoa," Quart. Journ. Micr. Sc. vols. vi., vii. 1858–1859 ; "Catalogue of Polyzoa collected by J. Y. Johnson at Madeira," *op. cit.* vol. viii. 1860–1861.

Hincks.—"The Madeiran Polyzoa," Ann. Mag. Nat. Hist. ser. 5, vol. vi. 1880, p. 69.

Johnson, J. Yate.—"New Cyclostomatous Bryozoa found at Madeira," Ann. Mag. Nat. Hist. ser. 6, vol. xx. 1897, p. 60.

Waters.—"Bryozoa from Madeira, &c.," Journ. R. Micr. Soc. 1899, pp. 6–16.

Norman.—"Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. 1909, p. 275.

Osburn, R. C.—"The Bryozoa of the Woods Hole Region," Bull. Bur. of Fisheries, vol. xxx. 1912 ; "Biological Survey of the Waters of Woods Hole and Vicinity," *op. cit.* vol. xxxi. pt. 1, p. 102, pt. 2, p. 595. 1913 ; "The Bryozoa of the Tortugas Islands, Florida," Publ. 182, Carnegie Inst. of Washington. 1914.

Points of Special Interest.

(1) The discovery of *Tubulipora* (*Proboscina*) *Lamourouxii*, Audouin, which has never been understood, so that the generic name *Proboscina* has been incorrectly used by some authors for forms allied to *Stomatopora* : p. 31.

(2) The way in which certain species of *Schizoporella* grow in layers, with the younger layer taking definite positions, frequently passing over the opercula. Together with this, the closures of the Cheilostomata are considered : pp. 15 & 16.

(3) The spines surrounding the zoœcia of *Cribrilina radiata,* Aud., and the formation of the zoœcia are considered : p. 11.

(4) A very interesting *Lichenopora* with confluent zoaria is more fully described. Some subcolonies are multiserial, others uniserial, and it is difficult to decide whether they should be considered as one or two species : p. 33.

(5) Several points relating to the classification of *Crisia* are dealt with : p. 24.

The collections made by Mr. Cyril Crossland consist of 45 species or varieties, of which 25 were already known from the Atlantic, 16 are British, 24 Mediterranean, and probably 17 are Australasian. Besides these, a list of 41 species already described from the Cape Verde Islands is given.

Table of Distribution from West to East.

	Page.	Atlantic *.	British.	Mediterranean.	Red Sea.	Indian Ocean.	Ceylon.	Australasian.	Fossil.	
Aetea recta, Hincks	5	+	+	+	...	...	...	+		Japan, E. Africa, Amboina, Lifu, Amirante, Azores, Canary Is., S. Afr.
Bugula dentata, Lamx.	5	...	...	...	...	...	...	+	...	
Scrupocellaria Bertholletii, Aud.	5	+	...	+	+					
„ *Macandrei*, Busk	6	+	...	+	...	+	...	+	...	Zanzibar.
„ *tridentata*, sp. nov.	7	...	...	...	...	...	...	...	...	
Beania hirtissima, Heller	8	+	...	+	...	...	...	+		
Membranipora tenuirostris, Hincks	9	+	+	+	...	...	...	+	+	
„ *curvirostris*, Hincks	9	...	+	+						
„ *quadricornuta*, sp.nov.	9	...	...	...	...	...	...	...	...	
Cribrilina radiata, Moll	10	+	+	+	...	+	...	+	+	Mauritius, Brazil.
Thalamoporella Rozieri, Aud.	13	+	+	+	+	+	+	+	+	
Schizoporella unicornis, Johnst.	14	+	+	+	+	...	+	...	+	Japan.
„ *spongites*, Pallas	16	+	...	...	...	...	+			
„ *oligopus*, Robertson	18	...	...	...	...	...	...	...	...	California.
„ *trichotoma*, sp. nov.	19	...	...	...	...	...	...	...	...	
Osthimosia avicularis, Hincks	19	...	+	+	...	+	...	...	+	
Hippothoa distans, MacG.	20	...	+	+	...	+	+	+	+	S. Africa.
„ *divaricata*, Lamx.	20	+	+	+	...	+	...	+	+	S. Africa.
„ *hyalina*, Linn.	20	+	+	+	...	...	...	+	+	
Arthropoma Cecilii, Aud.	20	+	+	+	+ ?	+ N. S.	+	+	+	
Chorizopora Brongniarti, Aud.	21	+	+	+	...	...	...	+	+	
Smittina trispinosa, var. *protecta*, Th.	21	...	...	...	+	N. +	+			
„ *tropica*, Waters	21	...	...	...	+					
Lepralia cucullata, Busk	21	+	...	+	+	...	...	...	+	California.
„ *peristomata*, Waters	21	+								
Schizotheca fissa, Busk	22	...	+	+						
Holoporella pusilla, Smitt	22	+								
„ *aperta*, Hincks	23	+	...	...	+					
Microporella ciliata, Pallas	23	+	+	+	+	+ N.	+	+	+	Japan.
Adeonella contorta, Mich.	23	+	...	...	+	...	...	...	...	Brazil.
Crisia tubulosa, Busk	26	+	...	+						
„ *denticulata*, var. *verdensis*, nov.	27	...	...	...	...	...	...	...	...	
„ *sigmoidea*, Waters	29	...	...	+						
„ *vincentensis*, sp. nov.	29	...	...	...	...	...	...	...	...	
Tubulipora pulchra, MacG.	30	...	...	...	...	...	...	+	...	S. California.
„ *Lamourouxii*, Aud.	31	...	...	...	...	...	...	...	...	
„ *incrassata*, Smitt.	32	...	...	+						
Lichenopora irregularis, Johnson	33	+								
„ „ var. *composita*, nov.	38	...	...	...	...	...	...	...	...	
Flustrella hispida, Fabr.	38	...	+							
Amathia tortuosa, T. Woods	39	...	...	...	+	...	...	+		
„ *Vidovici*, Heller	41	+	...	+	...	...	...	...	...	Roscoff, B.E. Africa.
Zoobotryon pellucidum, Ehr.	41	+	...	+	+	+	...	+		
Bowerbankia pustulosa, var. *alternata*, nov.	41	...	...	...	...	...	...	...	...	
Barentsia discreta, Busk	42	+ N. S.	...	...	...	...	...	...	...	S. Pacific; Cape Horn.
Pedicellina cernua, Hincks	43	+	+	+	...	...	...	+		

* Previously known from the Atlantic.

Busk described a few species from the Cape Verde Islands in the 'Challenger' Reports, also a few in his British Museum Catalogues, and Calvet described a considerable number in the "Bryozoaires du 'Travailleur' et du 'Talisman'"; so that the following are also known from the locality. A few species are omitted where there was doubt about the determination.

	Atlantic.	British.	Mediterranean.	Red Sea.	Indian Ocean.	Ceylon.	Japan.	Australian.	Fossil.	
Caberea ligata, Calv.	...	...	...	...	...	...	..	...	...	
Cellaria biseriata, Maplestone	...	...	...	...	...	...	...	..	+	
Beania magellanica, Busk	+ N S.	...	+	...	...	...	+	+	...	South Africa, South America.
Membranipora patellaria, Moll.	+	...	+	...	...	...	...	+		
,, *bellula*, Hincks	...	...	...	...	+	+	...	+		S. Africa, Amboina, Antarctic.
,, *cervicornis*, Busk	...	...	...	...	...	...	...	+	...	
,, *granulifera*, Hincks	+									
,, (?) *filum*, Jull.	...	...	...	...	...	...	...	...	...	
Onychocella angulosa, Reuss	+	...	+	...	...	...	...	...	+	
Setosellina Roulei, Calv.	...	...	..	...	...	...	...	...	...	
? *Schizotheca Talismani*, Calv.	...	...	...	...	...	...	...	...	...	
Smittina cervicornis, Pallas	...	...	+							
,, *jacobensis*, Busk	...	...	...	...	...	...	...	+	...	S. America, Marion Isl.
Porella lævis, var. *subcompressa*, Busk	...	...	...	...	...	...	...	+		
Trypostega venusta, Norman	+	+	...	...	+	...	...	+	+	Lifu, Mauritius.
Haswellia alternata, Calv.	...	...	...	...	...	...	...	...	...	
Porina borealis, Busk	+	...	...	...	...	...	...	...	...	N. Europe.
Lepralia brancoensis, Calv.	...	...	...	...	...	...	...	...	...	
,, *Poissonii*, Hincks	+	...	+	...	+	+	+	+	+	China, Tahiti, Mauritius, Zanzibar.
Ichthyaria avicularia, Calv.	...	...	...	...	...	...	...	...	...	
Mamillopora simplex, Kosch. (*Mamillopora Smittii*, Calv.)	...	...	..	...	...	...	...	...	+	
,, *Edwardsi*, Jull.	+									
? *Myriozoum strangulatum*, Calv.	...	...	...	...	...	...	...	...	..	
Retepora Imperati, Busk	...	...	+							
,, *ramulosa*, Calv.	...	...	...	...	...	...	...	...	...	
Cellepora intricata, Calv.	...	...	...	...	...	...	...	...	...	
Cupularia Oweni, Gray	+	...	+	...	...	...	...	...	+	
,, *umbellata*, Def.	+	..	...	...	...	...	...	...	+	
Adeona Heckeli, Reuss. (*Microporella violacea*)	+	+	+	...	...	...	...	+	+	
Adeonella insidiosa, Jull.	+									
Crisia ramosa, Harmer (*elongata*, Norm.)	...	+	+	+						
,, *conferta*, Busk	+									
,, *tenella*, Calv.	...	...	...	...	...	...	...	...	...	
Entalophora raripora, d'Orb.	+	+	+	...	...	...	...	+	+	
,, *reticulata*, Calv.	...	...	...	...	...	...	...	...	...	
,, *subverticillata*, Calv.	...	...	...	...	...	...	..	...	...	
Idmonea atlantica, Forbes	+	+	+	...	...	...	+	..	+	Kerguelen, Cape Horn.
Filisparsa superba, Jull.	+	...	...	...	...	...	...	...	..	S. Pacific?
**Hornera brancoensis*, Calv.	...	...	...	...	...	...	...	...	...	
Stomatopora granulata, M.-Edw.	...	+	+	...	...	...	...	...	+	Magellan, Tristan da Cunha.

* *Hornera eburnea*, Calvet, is mentioned by Calvet from Cape Verde Islands. In 'Bryozoa from Zanzibar," Proc. Zool. Soc. 1914, p. 836, I said it was doubtful why it was placed with *Hornera*, and since then Prof. S. J. Hickson has shown that it is (*Stylasterina*) Hydrocoralline.

AETEA RECTA, *Hincks.*

BUGULA DENTATA (*Lamouroux*), *Busk.* (Plate 1. fig. 1.)

Achamarchis dentata, Lamx. Hist. des Polyp. corall. p. 135, pl. 3. fig. 3 (1816).

For synonyms see Miss Jelly's Catalogue, and add:—

Waters, "Bry. N. S. Wales &c.," Ann. Mag. Nat. Hist. ser. 5, vol. xx. (1887) p. 91, pl. 4. fig. 14; Kirkpatrick, Proc. R. Soc. Dublin, n. s. vol. vi. (1890) p. 614; Ortmann, "Die Japan. Bry.," Arch. f. Naturgesch. vol. i. (1890) p. 25, pl. 1. fig. 20; Philipps, "Rep. on the Polyzoa coll. by Dr. Willey, from the Loyalty Isl. &c.," Willey's Zool. Results, pt. 4, p. 443 (1899); Thornely, "Mar. Poly. of the Indian Ocean," Trans. Linn. Soc., Zool. vol. xv. (1912) p. 141; Calvet, "Bry. d'Amboine," Rev. Suisse de Zool. vol. xiv. (1906) p. 617, pl. 21. fig. 1; Norman, "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 285, pl. 36. fig. 3.

Krauss speaks of the zoarium being "bleifärbig und dunkelgraue"; Macgillivray says greenish or leaden colour; Busk says "ovicell blue" (but did he not mean to refer to the zoarium?); Kirkpatrick says "the zoarium is of a leaden-blue colour"; Miss Philipps, in her Loyalty Island paper, says "zoarium leaden-blue"; and Miss Thornely, in her Indian Ocean paper, says "ovicells not blue"; Calvet did not find any colour, but says that the specimen had been many years in spirit. No one, however, seems to have noticed the curious fact that the polypides and growing tissue are blue, looking just as if they had been stained, and in these Cape Verde Islands specimens it is a fairly bright blue. The specimens left in spirit have lost their colour, and one set of spirit-specimens were always without colour. A spectroscopic examination of this species would surely be interesting

The geographical range is very great, occurring in many places from Japan to the Cape Verde Islands.

There are about 14 tentacles.

Loc. Australia, New Zealand, Tasmania, S. Africa, Torres Str., 6–7 fath.; Lifu (*Thornely*), Amirante, 29–34 fath. (*Th.*), Amboina (*Calvet*), Sagamibai, Japan, 70 fath. (*Ortmann*), Madeira (*Norman*); Boa Vista, Cape Verde Islands, 20 fath., collected by Crossland.

SCRUPOCELLARIA BERTHOLLETII (*Audouin*), *Hincks.*

For synonyms see Waters, "Mar. Biol. of the Sudanese Red Sea, Bryozoa," Journ. Linn. Soc., Zool. vol. xxxi. (1909) p. 133, and add:—

Scrupocellaria Bertholletii, Norman, "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 283, pl. 36. figs. 1, 2; Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 376.

There are some specimens closely attached to *Adeonella contorta*, Mich., with the creeping growth and attachment by radicles, as known in *S. reptans* (Linn.), Gray. On account of the resemblance of the two species I at one time spoke of *S. reptans*, var. *Bertholletii*.

There are some very large erect median avicularia, much larger than I have seen in any other specimens of *S. Bertholletii*. Hincks has mentioned

the irregularity of the median avicularia, and this I can confirm from Mediterranean specimens, in which some parts are without them, and others have them fairly regularly.

Loc. Naples, Capri, Rapallo, Trieste, Suez, Madeira; Cape Verde Islands, 110–180 met. (*Calvet*), and St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

SCRUPOCELLARIA MACANDREI, *Busk*. (Plate 1. figs. 3–7, 11.)

For synonyms see Waters, "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 477, pl. 58. figs. 5, 6.

This has a separable operculum (fig. 3), which seems to be general in *Caberea*, but not in *Scrupocellaria*. The oral parts are thrown back as in *C. Darwinii*, Busk, and the scutum comes up to the oral aperture, much as in that species. The vibracular chambers are larger than is usual in *Scrupocellaria* and spread diagonally halfway across the dorsal surface, but they are not as large as is usual in *Caberea*. The seta of the vibraculum is smooth as is general in *Scrupocellaria* *. It will be seen that this species has some characters of *Caberea*, showing how closely that genus is allied to *Scrupocellaria*. The seta is serrate, or, more strictly, spinous at one side only, in *C. grandis*, Hincks, *C. lata*, Busk, *C. rostrata*, Busk, *C. Ellisii*, Flem., *C. Boryii*, Aud., *C. Hookeri*, Busk, *C. glabra*, MacG., *C. bursifera*, Ort., *C. Darwinii*, Busk, *C. minima*, Busk. The vibracular seta has several irregular projections at the base, and at each side there is a separated curved chitinous piece, against which the vibraculum evidently works. The central vibracular muscles draw down the seta, and the sac-like "peculiar body" naturally varies in position with the movements of the seta; but, besides the large † muscles, there is another muscle placed further away from the beak (fig. 4, *m.*), attached to the flexible wall proximal to the seta, and thus the chamber-wall is drawn in, reminding us of the way in which the front membranous wall is drawn down in *Micropora*, *Steganoporella*, *Cupularia*, and other genera. The lateral muscles are attached to projections on the base of the vibracular seta (fig. 5).

There is a small median avicularium placed near to the base of the scutum. Miss Thornely refers to tall median avicularia. There is a chitinous arch from the inner side of the area below the scutum. The ovicell is imperforate, and there are 13 tentacles.

Loc. Coast of Spain; Adriatic; Lifu (*Thornely*); Queensland (*Haswell*); Zanzibar, 8 fath. (*Waters*); in the Indian Ocean (Providence, 50–78 fath., Amirante, 29 fath., Farquhar reef, Cargados, 30 fath., Seychelles, 34 fath.)

* In my paper on the Zanzibar Cheilostomata, Proc. Zool. Soc. 1913, p. 474, I unfortunately stated that the vibracula of *Caberea* were smooth, which presumably was a slip in transcribing.

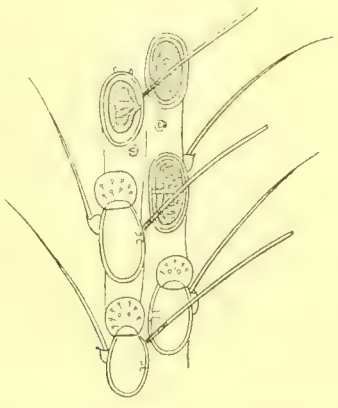
† With the circular movement of the seta it is questionable whether any of the muscles should be called retractor or occlusor

(*Th.*); St. Paul's Rock, N. Atlantic (*Chall.*); St. Vincent, Cape Verde Islands, 1070–1150 fath. (*Chall.*), Cape Verde Islands, 110–180 met. (*Calv.*); Boa Vista, Cape Verde Islands, collected by Crossland.

SCRUPOCELLARIA TRIDENTATA, sp. nov. (Plate **1.** figs. 9, 10.)

Zoarium spreading in all directions, forming a circular growth, in most respects agreeing with *S. cervicornis*, Busk, but below each bifurcation there is a very large raised avicularium, of which the mandible has three long narrow prongs, and the avicularian chamber folds inwards round three projections to receive these prongs as in a half-open tube (Pl **1.** fig. 10). In other parts there is an anterior avicularium on each zoœcium, just below the area *. Hincks describes avicularia below the area on a tall columnar process, in *S. cervicornis*, Busk.

Fig. 1.



Scrupocellaria tridentata, sp. nov. × 50.

There are about six oral spines, none of which are bifurcate; down the middle of the zoarium there are very long stout erect spines, and these in one internode will all belong to the zoœcia on the right side, whereas in the companion internode of the same age they will belong to the zoœcia on the left side, in both cases growing from near the distal end. Hincks refers to tall spines on each side of the branch in *S. cervicornis*, and when a colony of *S. tridentata* is seen from the side the spine appears to grow from the side.

The lateral avicularia are very minute, being smaller than those figured by Smitt † in his *S. cervicornis*. Smitt calls attention to the variation in the size of the lateral avicularia in *S. cervicornis*, and also makes comparisons of *S. pusilla*, Smitt, *S. cornigera*, Smitt, and *S. cervicornis*, Busk. MacGillivray figures the Australian form with large avicularian mandibles. This species, *S. cervicornis*, Busk, *S. cornigera*, Smitt, and *S. obtecta*, Hasw., have very

* Hincks, Ann. Mag. Nat. Hist. ser. 5, vol. xi. (1883) p. 103.

† "Floridan Bryozoa," Pt. I. p. 15 (1872).

similar scuta. There are about seven zoœcia in an internode. There is no separable operculum, the ovicell is perforate, the radicles are serrate, and the smooth vibracular setæ are about three times the length of a zoœcium.

Loc. Boa Vista, Cape Verde Islands, 20 fath., collected by Crossland.

BEANIA HIRTISSIMA, *Heller*. (Plate 1. fig. 2.)

Diachoris hirtissima, Heller, "Die Bryozoen des Adriat. Meeres," Verhand. der k.k. zool.-bot. Gesellsch. Wien, vol. xvii. (1867) p. 94, pl. 1. figs. 6, 7; Busk, Rep. of the Voyage of H.M.S. 'Challenger,' vol. x. Polyzoa, p. 61 (1884).

Chaunosia hirtissima, Busk, Q. Journ. Micr. Sc. n. s. vol. vii. (1867) p. 241, pl. 36. figs. 12–14.

Beania hirtissima, Waters, "On the Use of the Avicularian Mandibles in determination of the Cheil. Bry.," Trans. Micr. Soc. ser. 2, vol. v. (1885) pl. 14. fig. 5; "Bry. from Rapallo, &c.," Journ. Linn. Soc., Zool. vol. xxvi. (1896) p. 17; "Bry. from Madeira," Journ. R. Micr. Soc. 1899, p. 15; Calvet, "Bry. Mar. de la Rég. de Cette," Trav. Inst. de Zool. de l'Univ. de Montpellier, ser. 2, Mém. 11, p. 24 (1902); Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 392; Norman, "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 286.

In the specimens from the Cape Verde Islands there are no radicle-tubes, and none seem to occur in the typical form of this species from other localities, so far as examination has gone, but there are, in these Cape Verde specimens, delicate spines which sometimes are entire, but more often they bifurcate near the base, and usually there are two such spines on the dorsal surface of each zoœcium. Busk, in describing his *Chaunosia* the same year as Heller with the same specific name, refers to the bi-trifurcate dorsal spines. The zoarium of Busk's *Chaunosia* is like the form of *cylindrica* of Hincks. In looking carefully through some specimens from Naples and Rapallo a few such spines, similarly bifurcating, were found, but only in isolated cases, whereas they are very numerous in the Cape Verde specimens, which in most respects correspond fairly closely with the Mediterranean specimens. On the anterior border there are about nine delicate spines on each side, while further away from the border, with no great regularity, there are a number of much stouter spines. Round the distal part of the aperture there are usually seven fairly stout spines with other spines nearer to the dorsal surface.

The variety *robusta*, Hincks, which I think might well be separated as a species, has long thin dorsal tubes or radicles; *B. conferta*, MacG., has numerous long dorsal spines; *B. spinigera*, MacG., has no dorsal spine or tube; *B. elongata*, Hincks, has a small dorsal tube near the distal end; *B. magellanica*, Busk, has a wide radicle-tube near the distal end, thus showing the value of the dorsal surface in determination.

Loc. Adriatic, Naples, Capri, Rapallo, Villefranche-sur-Mer (*Waters*), Ajaccio, (*Calvet*); Madeira (*Waters & Norman*); New Zealand (var. *robusta*); St. Vincent, Cape Verde Islands (*Chall.*); St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

MEMBRANIPORA TENUIROSTRIS, *Hincks*.

Membranipora tenuirostris, Hincks, Ann. Mag. Nat. Hist. ser. 5, vol. vi. (1880) p. 70, pl. 9, fig. 3; *op. cit.* ser 5, vol. x. (1882) p. 7; *op. cit.* ser. 5, vol. xix. (1887) p. 314; Waters, Journ. R. Micr. Soc. ser. 2, vol. v. (1885) p. 775, pl. 14, fig. 41; Quart. Journ. Geol. Soc. vol. xlvii. (1891) p. 11; Journ. Linn. Soc., Zool. vol. xxi. (1898) pp. 668 & 685, pl. 47. fig. 7.

Membranipora Flemingii, Waters, Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 122, pl. 13, fig. 2.

In the specimens from the Cape Verde Islands some parts have the spines as figured by Hincks, whereas in others there are none. In my paper on Membraniporidæ I referred to the spines not occurring in Naples and Rapallo specimens.

Loc. Queen Charlotte Islands (*Hincks*); Madeira on *Pinna* (*Hincks*); Naples, low water to 40 fath.; Capri; Rapallo; Adriatic; Oran (Algiers), 54 fath.; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Fossil. Bartonian and Pliocene of Italy.

MEMBRANIPORA CURVIROSTRIS, *Hincks*.

Membranipora curvirostris, Hincks, Ann. Mag. Nat. Hist. ser. 3, vol. ix. (1861) p. 295 (39), pl. 7. fig. 4; Brit. Mar. Polyzoa, p. 153, pl. 20. figs. 5, 6 (1880); Ridley, Proc. Zool. Soc. 1881, p. 46; Waters, Journ. Linn. Soc., Zool. vol. xxvi. (1898) pp. 668 & 684, pl. 47. figs. 2, 12.

Some of the zoœcia have a median spine below the area, also one or two spines in various other positions. There is the unoccupied space above the avicularium as in the British and Naples specimens.

Loc. British, Polperro, 40 fath.; Singapore?; Brazil, 35 fath. (*Ridley*); Naples; St. Vincent Harbour, Cape Verde Islands, 10 fath., on clinker and from a diver, collected by Crossland. * [Dwarka, Arabian Sea (*Thornely*).]

MEMBRANIPORA QUADRICORNUTA, sp. nov. (Plate 1. fig. 8.)

There are incrusting specimens from St. Vincent Harbour, Cape Verde Islands, 10 fathoms. The opesia is oval, and at the distal end on each side there is a short cervicorn spine, and lower down there is another pair. There are a considerable number of vicarious avicularia just like those of *M. crassimarginata*, Hincks †—in fact, the species is like *M. crassimarginata*, except that there are two pairs of cervicorn spines. The avicularia are about as long as the ordinary zoœcia, but not quite so wide. The border is crenulated.

There is one distal rosette-plate about the middle of the distal wall, and two lateral rosette-plates about halfway between the anterior and basal wall.

There is considerable irregularity in the spines, for the lateral ones at first have only two points, whereas later there may be several divisions, and those

[* Thornely, Hyd. & Poly. coll. at Okhamandal in Kattiawar. 1916.

† Ann. Mag. Nat. Hist. ser. 5, vol. vi. (1880) p. 71, pl. 9. fig. 1.

from opposite sides may interdigitate, or in a few cases may be fused together, thus forming a good protection. In some cases there is a second spine on each side near the proximal end, but this is not common; also in one zoœcium I have found a central proximal spine. The oral spines stand erect, and therefore it is impossible to give an idea of them as seen from above—consequently a few pressed down are drawn to show the shape.

Cribrilina radiata (*Moll*), *Smitt*.

The specimens from the Cape Verde Islands are fairly typical *C. radiata*, a species subject to much variation. They have about 11 ribs, and there are 5–7 pores in a ray. There is no suboral pore visible, but in dried specimens, afterwards decalcified, a row of 6 pore * disks is seen below the aperture with a single pore in the middle, the same size as the others, but this semicircle of pores must probably be considered as the upper series of the radial pores. On each side of the central pore there is usually a small nodule. By the side of the more or less oval zoœcia there are elongate avicularia, as frequently described; as is generally the case in *Cribrilina*, there is no avicularian cross-bar, though one occurs in *C. monoceros*, Busk, which, however, most workers would now remove from *Cribrilina* on other grounds. The large bordering spines to which reference will be made are about 11, the two upper ones, being much longer than the others, have been mistaken for setæ or vibracula.

In a stained specimen, from Rapallo, the small frontal pores are each in the centre of a much larger disk.

The ovicells have nodules, and sometimes a keel dividing to each lower corner.

The opercula are separable and are of quite the same type as in *C. punctata*, Hass., *C. Gattyæ*, Hincks, *C. Balzaci*, Waters, and I fail to see any reason for separating a genus *Puellina*, Jullien, as maintained by Levinsen.

The primary zoœcium has 11 spines, while that of *C. punctata*, Hass., has 12 (Harmer), that of *C. projecta*, Waters, has 12, that of *C. monoceros*, Busk, has 9 (Harmer), that of *C. Gattyæ*, Hincks, has 11, while the closely allied *C. Balzaci*, Waters, has a primary zoœcium similar to the ordinary zoœcia, and this, according to Harmer, is also the case in *C. annulata*, Fabr. The primary of *Membraniporella nitida*, Smitt, has 10 spines fairly regularly surrounding the zoœcium, but it may be seen that 6 are oral spines and 4 zoœcial. Hincks evidently made a mistake in describing 14 spines, for his figure in Brit. Mar. Poly. pl. 27. fig. 6 is clearly not a primary. In *M. nitida* a number of zoœcia, after the primary, have a Membraniporidan character somewhat like *M. lineata*, Hincks, and taking a fairly typical colony of *M. nitida* from Oban, Scotland, the second series have

* In speaking of pores it is not meant that there is a direct opening to the interior.

6 oral spines and two or three delicate zoœcial ones. The following series have 4 distal spines and 2 oral. None of the subsequent zoœcia have lateral spines, while in the next series (circle) there are two zoœcia with two distal spines and one oral on each side; whereas two other zoœcia in the same series have the flat spines characteristic of *nitida* and meeting in the median line. Thus the early zoœcia are distinctly Membraniporidan, in each row approximating gradually to the mature *nitida*.

There are several cases in the Cellularidæ, and other families, in which the zoœcia immediately following the primary are intermediate between it and the following zoœcia.

Hincks, Norman, and Levinsen have placed *Membraniporella* under Cribrilinidæ, and Norman * has written a lengthy description of the bars or spines, comparing them with other Cribrilinidæ, but what he describes as the loop is only the base of the spine arising from the lateral wall. His figures (pl. 8. figs. 8, 9) are difficult to understand without examination of specimens and are far from satisfactory. The bars are simply spines such as we see in many *Membraniporæ*, and they do not touch their neighbours at the side continuously for the whole length. These spines are an arch over the frontal membranous wall with which they are not in contact, and the operculum, which is of a Membraniporidan type, is not separable, and is in the membrane in no way connected with the spines. We may ask if there is any reason for generically separating it from *Membranipora*, and must answer, No—as Smitt has already done.

The ridges of *Cribrilina* have been supposed to show that it was very closely allied to *Membraniporella nitida*, but the difference is much greater than first appearances suggest.

In 1879 † I mentioned minute spines round the area of *C. Gattyæ*, Hincks, and since then Harmer ‡ has described spines surrounding *C. radiata* §. I have made decalcified and stained preparations, and even decalcified preparations of dried specimens of various species, for they often show important structures, and these preparations led me to doubt the theory of the frontal wall being formed of confluent spines. My decalcified preparations of *C. radiata* from several places show a row of bluntly pointed, erect spines round the border of the zoœcium, with the two distal ones much longer and narrower than the others, and acute. Of course, these free erect spines have

* "Natural History of East Finmark," Ann. Mag. Nat. Hist. ser. 7, vol. xii. (1903) pl. 8. fig. 13, pl. 9. figs. 4, 6.

† "Bry. of the Bay of Naples," Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 36, pl. 9. fig. 6 *a*.

‡ "On the Morphology of the Cheilostomata," Q. Journ. Micr. Sci. vol. xlvi. p. 326.

§ Probably these must be compared with the large stout spines which I figured round *Hippothoa Brongniartii*, d'Orb. in Ann. Mag. Nat. Hist. ser. 7, vol. xv. (1905) p. 10, pl. 1. figs. 2–4; and also with the spines of *Lepralia Poissonii*, Hincks.

nothing to do with the ribs (ridges). I am thus able to confirm part of what Harmer has written on this point, though it may be somewhat differently stated, and the rows of small radial pores are, as mentioned by Harmer, in line with these spines, and in between are the ribs. We have been accustomed to speak as if the ribs were the most important frontal structure, whereas it seems that it is the pores which are the more important, with the ribs produced later and of secondary importance. In specimens of *C. Balzaci*, and in other species the young zoœcia, with only a membranous front, show the pore disks before any calcification takes place, and we may see in many forms that calcification has formed round these pore disks; and Norman in his figures of *C. nitido-punctata*, Smitt, and *C. Gattyæ*, Hincks, shows a thicker calcareous deposit round the disks, though he did not appreciate the importance of his observation. Where there is a distinct area, as in *C. Balzaci*, &c., and in *C. figularis*, Hincks, there is a surrounding row of large pore disks, often dark and chitinous, with smaller transparent pores, radiating from the centre, from these large disks. These large pores are probably vestigial, seeming to give a record of ancestors having had spines. The frontal wall of *C. radiata* occurs right up to the spinous circle, and may be attached to the spines, but this does not justify our assuming that the frontal wall of either *C. radiata* or other *Cribrilinæ* is formed by overarching spines, and it is the supposed resemblance to *Membraniporella nitida* which has led to this assumption. There are a great many species in various genera in which there is a more or less radial arrangement of the pores, and a fuller study of *Cribrilina* should explain various structures, for of course the spines and pores show a close developmental connection, even though former explanations may not be correct.

The opercula measured range in size from *C. radiata* (form called *setosa*, Waters) 0·07–0·08 mm.; *C. radiata*, Cape Verde Islands, 0·08 mm.; *C. Gattyæ*, 0·07 mm.; *C. radiata*, some specimens, 0·1 mm.; *C. Balzaci*, 0·1 mm.; *C. punctata*, Hass., 0·12 mm.; *C. patagonica*, Waters, 0·15 mm.; *C. figularis*, Hincks, 0·17 mm.; *C. latimarginata*, Busk, 0·2 mm.; *C. monoceros*, Busk, and *C. acanthoceros*, MacG., 0·22 mm.

C. patagonica, Waters, has on the under surface of the operculum projections of a *Membranipora* type.

Norman* still considers that there are two species, *C. radiata* and *C. innominata*, although most workers have united them, but in my own collection I am unable to find characters by which they can be separated. In British, Naples, and Madeira specimens, which Norman would probably call *innominata*, there are frequently many avicularia, though some specimens may have few or none. The number of ribs varies from 8–20; the elevation of the so-called bars is not a satisfactory distinction.

* "Polyzoa of Madeira," &c., Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 291.

It is advisable to call attention to the similarity between the primary zoœcia described by Smitt in his *Discopora coccinea* *, *D. ventricosa* †, Smitt, *D. stenostoma* ‡, Smitt, and the mature zoœcia in certain *Cribrilinæ* such as *C. Gattyæ*, *C. Balzaci*, and to a certain extent *C. figularis*, Hincks.

Loc. Very widely distributed. St. Vincent Harbour, 10 fath., collected by Crossland.

Fossil. Eocene, Miocene, and Pliocene.

THALAMOPORELLA ROZIERI (*Audouin*), *Hincks*. (Plate 4. figs. 9, *a*, *b*, *c*.)

For synonyms and localities see Waters, "Bryozoa of the Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. (1909) p. 141, pl. 15. figs. 12–15, and add :—? Robertson, "Incrust. Chil. Bry.," Univ. of California, Pub. Zool. vol. iv. (1908) p. 277, pl. 17. figs. 27, 27 *a*, 28, 29, pl. 18. fig. 30; Levinsen, Morph. & Syst. Studies on the Cheil. Bry. p. 181, pl. 6. figs. 6 *a*–6 *k*, pl. 6 *b*. figs. 1 *a*–3 *b* (1909) ; ? Osburn, "Bry. of the Tortugas Islands, Florida," Publ. 182, Carnegie Inst. of Washington, p. 196 (1914).

Vincularia novæ-hollandiæ, Haswell, Proc. Linn. Soc. N.S. Wales, vol. v. (1881) p. 41, pl. 3. fig. 3.

Thalamoporella novæ-hollandiæ, Levinsen, Morph. & Syst. Studies on the Cheil. Bry. p. 185, pl. 6 *a*. figs. 3 *a*–3 *f* (1909).

The form from the Cape Verde Islands is the same as that from the Red Sea, described by me in the "Sudanese Red Sea" Report, which must be taken to represent the type well figured by Savigny, who apparently found no avicularia, and the opercular knobs were very pronounced; but in the Cape Verde Islands specimens there is great variation in this respect, and sometimes in the younger parts of a colony none are seen, whereas in older parts they occur as figured by Savigny. This is a very variable character throughout the family. Of the varieties figured by Hincks § the one most nearly approaching the Red Sea form is *Steganoporella Rozieri*, var. *indica*, Hincks, whereas the variety *falcifera* seems entitled to specific rank as proposed by Levinsen. Probably var. *labiata*, Levinsen, should also be given generic position as the type of avicularia is different.

Most of the zoœcia are about 0·65 mm. long, but some are longer, others shorter, and this is about the size of co-type specimens of *T. novæ-hollandiæ*, Hasw., sent to me by Haswell. These I have considered were *T. Rozieri*, but as my specimens were without membranes they were not suitable for studying the spicules; however, examination shows a "curve" (spicule), which Levinsen says does not occur. It is somewhat larger than the average size in *T. Rozieri* from the Red Sea and Cape Verde Islands. My specimens of *novæ-hollandiæ* are cylindrical and hollow, while Levinson speaks of the colonies being partly incrusting, partly free hollow branches, and I see no

* "Krit. Förteck. öfv. Skand. Hafs-Bry.," Öfv. Kongl. Vet.-Akad. Förh. (1867), Bih. pl. 27. fig. 163.

† Ib. (1871) pl. 21. fig. 31. ‡ Ib. (1871) pl. 21. fig. 29.

§ Ann. Mag. Nat. Hist. ser. 5, vol. vi. (1880) p. 379, pl. 16. fig. 1.

sufficient ground for separating *T. novæ-hollandiæ* from *Rozieri*. Further cleaning of one of my specimens, sent by Haswell, revealed an avicularium similar to the one figured by Levinsen. With ovicells and avicularia unknown, it was difficult to be certain of the specific identity.

Levinsen's studies of the spicules in *Thalamoporella* are most important, but we do not know much as to the positions in which they occur, nor as to their object. In *T. Rozieri* from both the Red Sea and Cape Verde Islands there are two bundles of the long straight spicules starting from near the opercula and passing diagonally by the walls of the opesiules to the lateral walls, near the basal wall (Pl. 4. fig. 9). The long straight spicules are mostly free in the zoœcium, and at one time I wondered whether they were arranged in this way by the polypide passing in and out of the zoœcium, but these bundles occur in very young zoœcia before any calcareous frontal wall or operculum is formed. There are on, or in, the membranes spicules which Levinsen called curves, but in the sponges they would be called sigmas or arcuate spicules, and perhaps it would be well to speak of them as sigmas. These are remarkably abundant in *Th. Jervoisi*, H., and *T. mamillaris*, Lamx., from various localities. A specimen of *Jervoisi*, from Queensland, in my collection, has these spicules in great abundance in both the basal and frontal membranes, and at the growing end where the beginning of the lateral wall is only just indicated, on the supporting seaweed, these sigmas are massed in abundance.

Dr. Alice Robertson considers that her specimens, from La Jolla, California, are var. *indica*, Hincks, which hardly seems to differ from the type, others from San Pedro are articulated, and I expect this will ultimately be generically separated. Osburn considered his specimens from Tortugas Island were var. *labiata*, Levinsen, but the difference of the avicularium as figured by Levinsen may suffice to make *labiata* a genus. I do not consider that the presence or absence of avicularia is of first class importance, as often some colonies of *Thalamoporella* may have them while others are without; on the contrary, the type of avicularium and mandible is of material importance.

Localities, additional. California, few fath.: San Diego (*Robertson*), Florida, Jamaica, Tortugas Bay; Cape Verde Islands, St. Vincent Harbour, 10 fath., collected by Crossland.

Schizoporella unicornis (*Johnston*), *Pergens*. (Plate 2. figs. 14–17, 22.)

For synonyms see Waters, "Bryozoa of the Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. (1909) p. 143, pl. 12. figs. 12, 13, and add:—

Nordgaard, Die Bry. des West Norweg. p. 86 (1903); Hydrog. & Biol. Invert. in Norwegian Fiords, p. 165, pl. 5. figs. 23–25, 27 (1905); Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' vol. viii. (1907) p. 417; Norman, "Polyzoa of Madeira and neighbouring Islands," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 303; Osburn, "Bry. of Woods Hole Region," Bull. Bur. of Fisheries, vol. xxx. (1912) p. 236, pl. 25. fig. 48, pl. 30. fig. 91; "Bry. of the Tortugas Islands, Florida," Publ. 182, Carnegie Inst. of Washington, p. 205 (1914); Waters, "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 501.

Crossland sent some thick pieces from underneath a coal-lighter, in St. Vincent Harbour, Cape Verde Islands, and says, "this is the first of the host of forms to make an attachment to the lighter." One block was about 170 mm. × 140 mm. and 7 mm. thick. Some colonies occur on a stone brought up by a diver. In my last two papers * it has been pointed out that the zoœcia are frequently superimposed, and this I referred to in a species of *Meliceritites*. Reuss has shown the same thing in *Cumulipora angulata*, v. Maehr, and Lee † calls attention to Ulrich ‡, saying, "in the Trepostomata and many Cryptostomata the tubular zoœcium really represents a series of superimposed cells."

This species shows the "closures" more clearly and distinctly than any other I have come across. The calcareous matter is evidently deposited by a cellular tissue over the operculum. When a zoarium consisting of several layers is examined from below, the chitinous opercula in the older layers may nearly all be seen remaining in the oral aperture in their natural position, and when the zoœcia from these lower layers are examined from above the opercula are mostly without any calcareous growth, while others have a calcareous layer over part or all of the operculum. Near the centre of the operculum, or rather distal to the centre, a tubule grows through this super-opercular deposit, which may be quite short (figs. 14, *a*, *b*) or may form a noticeable tube, for in one case a fine tubule joins the inner wall of the next layer of zoœcia (fig. 14, *d*). The mandibles in *S. spongites*, Smitt, are also sometimes similarly covered with a calcareous deposit.

Schizoporella viridis, Thornely, in large masses, shows in the upper layers no calcareous deposit on the opercula, nor any tubule or tubercle; but when the upper layer is scraped away, then the opercula of the underlying zoœcia are mostly seen to have a stout tubercle over the middle, but only in a few cases is there any calcareous deposit. The new zoœcia in *S. viridis* are placed irregularly, quite independently of the layer below, and only accidentally do the walls of the new zoœcia pass over the old opercula, but where this has occurred there is in one or two cases a thickening of the operculum under the new wall. We thus see that the position of the layers of zoœcia is quite different in *S. viridis* (fig. 18) to what occurs either in *S. unicornis* or in *S. porelliformis* §, nov. (Pl. 2. figs. 19–21, an African

* "Bry. Sudanese Red Sea," Journ. Linn. Soc., Zool. xxxi. (1909) p. 144; "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 502.

† "Brit. Carb. Trepostomata," Mem. Geol. Surv. of Great Brit., Paleont. vol. i. pt. 3, p. 145 (1912).

‡ Ulrich, E. O., "Pal. Bry.," Pal. of Illinois, Geol. Survey Illinois, vol. viii. pt. 2, p. 322 (1890).

§ *Schizoporella porelliformis*, sp. nov. (Pl. 2. figs. 19–21). It is much like *S. nivea* in most characters, but is larger with larger aperture, &c. The surface and the large round ovicells have large pitted pores. It is bi-multilaminate. The oral aperture is nearly round, as the sinus is nearly the width of the aperture. The operculum has the muscular attachments at the side, and not from bosses distant from the border. There are one or two small oval avicularia at each side of the aperture.

species which I have long known in manuscript), there being important specific differences in each.

The closures and tubules are very important, as the same thing occurs in various recent and fossil Cheilostomata *, though often called "opercula," as it has frequently been supposed that the aperture was closed by this calcareous film, independently of the chitinous operculum, whereas from analogy we may feel sure that the calcareous deposit was formed over the operculum, there being therefore an important structural difference in the closures of the Cheilostomata and Cyclostomata, so that, in fact, it is doubtful whether the name closure should be used for the deposit in the Cheilostomata.

In *Meliceritites* (fossils very abundant in the Jurassic and Cretaceous formations) the closures with tubules are very common, and I have shown that the family had avicularia with mandibles; it also had opercula, and we now know that such closures and tubules are not restricted to the Cyclostomata. The new layer in some species of *Meliceritites* has the distal wall passing over the operculum of the under layer just as described in *Schizoporella nivea* †, Busk. Further, the shape of the zoœcia in *Meliceritites* is not regularly tubular as in Cyclostomata. As we have several truly Cheilostomatous characters I have protested against *Meliceritites* being called Cyclostomata; on the other hand, Gregory and Levinsen have shown that the large ovicells have Cyclostomatous characters, which may be sufficient to prevent the family being placed with Cheilostomata; certainly it should never be called Cyclostomata.

Levinsen ‡ speaks of layers of growth being a Cyclostomatous character, but there are several *Schizoporellæ* with multi-layered growth, and this is often the case in *Adeonella*, *Cellepora*, *Micropora*, &c.

In examining the opercula of *S. unicornis* in decalcified material I came across a very abnormal double one, having two proximal ends, each with a wide arc, like those of the normal form, and there are four muscular dots (fig. 22).

Loc. Generally distributed in the northern hemisphere and the tropics. St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

SCHIZOPORELLA SPONGITES (*Pallas*), *Smitt*. (Plate 2. figs. 10–13.)

Eschara spongites, Pallas (*pars*), Elenchus Zoophytorum, p. 47 (1766).

Hippothoa spongites, Smitt, Floridan Bryozoa, p. 42, pl. 8. figs. 161–163 (1873).

Schizoporella spongites, Thornely, Report on Pearl Oyster Fisheries of the Gulf of Manaar, p. 114 (1905); Levinsen, Morph. & Syst. Studies on the Cheil. Bryozoa, p. 324, pl. 18. figs. 4 *a–d* (1909); Osburn, "The Bryozoa of the Tortugas Islands, Florida," Publ. 182, Carnegie Inst., p. 207 (1914).

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* "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 504.

† "Bry. from Zanzibar," Proc. Zool. Soc. 1913, pp. 503, 504.

‡ "Studies of the Cyclostomata Operculata," K. Danske Vid. Skr. vol. x. (1912) p. 19.

From the Cape Verde Islands there are two specimens, one of which is 11 cm. × 7 cm. They are solid, many-layered masses (up to 25 layers), rising in places into large mammillated mounds. These specimens are white and have been dead some time, as there are no opercula. Besides these there are a few colonies growing on stone forming one or two layers. Lower than the oral aperture, on one or both sides, there is a small avicularium with acute mandibles, and there is sometimes a small central umbo. The frontal surface is perforated, except just below the aperture, and there are large vicarious avicularia scattered about. Above the oral aperture there is a lined or crenulated ridge. The oral aperture has two denticles by the proximal edge, as can be seen from above (fig. 11), or better from the interior (fig. 12), and the operculum shows two hollows into which these denticles fit: these are what Busk calls "foramina" in *Cellaria*, and I have shown * that they are sockets into which the teeth fit. The operculum is drawn from a specimen from Manaar, kindly given to me by Miss Thornely, and with regard to the minute details of the aperture and the surrounding ridge, &c., it corresponds in every detail with the specimens from Cape Verde, but does not have more than two layers of zoœcia in any part.

The ovicell is very large, being about twice the size of that of *Schizoporella unicornis*, Johnst., with a pitted surface, and at the opening two denticles directed distally, but I have not seen them nearly meeting, as figured by Levinsen. The ovicell usually quite conceals the oral aperture, and it is quite exceptional for any trace of the aperture to be seen, as already mentioned by Levinsen.

The large vicarious avicularia occur frequently in a large number of species called *Cellepora*, and certainly most of the older writers would have placed this, with its solid irregular growth, under *Cellepora*; however, it has long been recognized that many species known as *Cellepora* must be united to *Schizoporella*.

I have said † that the *Cellepora spongites*, Pall., was *Schizoporella unicornis*, the form which I called *errata*, and this I consider to be the case, but apparently, from the reference to previous figures, and from his description, Pallas was considering three distinct species, namely *Schizoporella unicornis*, and *S. sanguinea*, Norm., both from the Mediterranean, while the one he last refers to from America is what Smitt placed as *S. spongites*, though where only zoarial characters are referred to it is impossible to speak with absolute certainty, as two species may correspond zoarially. The first two species are now well known under other names and "*spongites*" has been used by several authorities, so that even if rules should suggest a new name it would seem as if the plan adopted by Levinsen is the best—that is, to call it *S. spongites* (Pallas), Smitt.

* Report of the Voyage of the 'Challenger,' vol. xxxi. pt. 79, p. 16.

† Journ. Linn. Soc., Zool. vol. xxxi. (1907) p. 145.

In figure 10 the zoœcia from various parts of the colony are placed together to show the characters.

Loc. Florida, 13–35 fath. (*Smitt*); Bermuda (*Verrill*); Ceylon (*Thornely*); West Indies and Malacca (*Levinsen*); on a coral from S. Africa in the Jelly Collection in the Victoria University Museum; Cape Verde Islands (St. Vincent Harbour, 10 fath.), collected by Crossland.

? Schizoporella oligopus, *Robertson.* (Plate 2. figs. 5, 6.)

Schizoporella oligopus, Robertson, "The Incrusting Chilostomatous Bryozoa of the West Coast of North America," Univ. of California, Pub. in Zool. vol. iv. (1908) p. 292, pl. 20. figs. 50, 51, 52.

The radicles occur to nearly all the zoœcia, and are seen at the growing edge, even when no polypides have been formed, the number is most frequently 6–8 but there may be 10, and a few zoœcia have none. Similar chitinous radicle-tubes occur in many Cheilostomata—for instance, in *Membranipora patellaria* (Moll), Waters *, which is often thus attached to large *Melobesia*, and the specimen of *S. oligopus* from the C. Verde Is. is also on *Melobesia*. These radicles are at first a tubular projection at the end of which is a chitinous tube attached to the *Melobesia*.

At the junction of the zoœcia there is a space, as mentioned by Dr. Alice Robertson. My specimens of *S. argentea*, Hincks, from Tahiti, which are co-types, do not show the spaces at the junction of the zoœcia, nor do those from the Red Sea, which have a calcareous opaque area in the middle of the dorsal surface, as described by Hincks, and there is considerable irregularity in the number of radicles.

The anterior surface of the zoœcia does not usually show pores round the border, but, when examined from the interior, a row at the border is seen between the granula and over the surface generally, but none are visible until Eau de Javelle has been used.

The position of the avicularium close up to the oral aperture on one side and the thin operculum led to my calling it *Rhamphostomella* before recognizing that it had been described. It will be noticed that while the umbo is central, when there is no avicularium, yet when an avicularium occurs the umbo is on the other side. The aperture of the ovicelligerous zoœcia are much wider than those of the other zoœcia and are differently shaped, as the sinus is less marked. This is not alluded to by Dr. Alice Robertson, but the figures indicate a difference. No difference is noticeable between the zoœcial and ovicelligerous apertures of *S. argentea*. No spines have been seen. There are about 16 tentacles. It must remain an open question whether the difference (if any) in the frontal pores justifies a variety or new species.

* Waters, "Bry. of the Bay of Naples," Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 120, pl. 10. figs. 8, 9.

Loc. San Pedro, California (*Robertson*). St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

SCHIZOPORELLA TRICHOTOMA, sp. nov. (Plate 2. figs. 1–4.)

The zoarium is adnate, incrusting clinkers.

The zoœcia are ovate, with pores spread over the surface, which under a low power appear stellate ; the oral aperture is large, with a distinct sinus on the straight lower edge, and straight sides ; at the distal end of the zoœcium there are four spines. The operculum has a diagonal ridge at each side.

The decalcified frontal zoœcial wall shows that the upper membrane has, at the position of each pore, three oval disks, then below this in the lower membrane there is a circular disk with a spot in the centre (fig. 3).

The raised ovicell has a median ridge and a mucro, with ridges from the mucro to the distal end of the aperture. There are pores round the edge of the ovicell.

The primary has eleven spines.

Only dried specimens have been met with.

Schizoporella divisopora, Waters *, and *S. pulchra,* Neviani †, both have stellate pores, but the ovicells do not quite correspond, though the main characters are the same in *S. divisopora,* so that the recent species are closely related.

Loc. St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

OSTHIMOSIA AVICULARIS (*Hincks*), *Waters.*

For synonyms see Miss Jelly's Catalogue under *Cellepora avicularis,* Hincks, and Calvet's Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 441.

Cellepora americana, Osburn, "Bry. of Woods Hole," Bull. of the Bureau of Fisheries, vol. xxx. (1910) p. 238, pl. 25. figs. 52 *a, b* ; pl. 31. fig. 99.

There is only one specimen, which is about 5 mm. high, the zoarium is massive with three or four short lobes. The rostrum to the oral aperture is usually short, but there is generally in this species much variation in this respect. In specimens from Naples sometimes there is quite a long rostrum with avicularia on the inner side, while others in the same specimens have much shorter ones with the mandible near the end. It therefore seems that the Mediterranean form includes the differences mentioned by Osburn, who says his *C. americana* is related to *avicularis.* The large vicarious avicularia, with nearly parallel sides, are abundant in some parts of the specimen.

Loc. Arctic ; British ; Mediterranean at Naples, Rapallo, Cette, Corsica,

* "Bry. from N. S. Wales, &c.," Ann. Mag. Nat. Hist. ser. 5, vol. xx. (1887) p. 193, pl. 5. fig. 4.

† "Bri. foss. della Farnesiana," Pal. Ital. vol. i. p. 110, pl. 5. figs. 36, 37 (1895).

Oran (Algiers) ; Florida ; Vineyard Sound, Buzzard Bay, 1–19 fath., No Man's Land, Nantucket, Sandwich (*Osburn*); from underneath a coal-lighter in St. Vincent Harbour, Cape Verde Islands, collected by Crossland.

HIPPOTHOA DISTANS (*Hincks*).

Cosmopolitan.

HIPPOTHOA DIVARICATA, *Lamouroux*.

For synonyms see Miss Jelly's Catalogue, and add:—

Waters, Résult. du Voyage du S.Y. 'Belgica,' Bryozoa, p. 53, pl. 7. fig. 3 (1904); "Bry. from near Cape Horn," Journ. Linn. Soc., Zool. vol. xxix. (1904) p. 238; "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 501; Nordgaard, Hyd. & Biol. Invest. in Norwegian Fiords, p. 165 (1905); Robertson, "Incrust. Chil. Bry. of N.W. Coast of America," Univ. of California, Pub. Zool. vol. iv. (1908) p. 296, pl. 21. figs. 59, 60; Norman, "Polyzoa of Madeira," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 299.

Loc. Cosmopolitan, including Woods Hole, Madeira, and between Fayal and Pico. From slight depths to 1000 fathoms.

HIPPOTHOA HYALINA (*Linnæus*), *Waters*.

For synonyms see *Schizoporella hyalina* in Miss Jelly's Catalogue, and add:—

Mollia hyalina, Barrois, Emb. des Bry. p. 163, pl. 9. figs. 4–17 (1877).

Schizoporella hyalina, Levinsen, Zool. Dan. 'Danske Dyr' (1894), p. 66, pl. 5. figs. 47–57; Robertson, "Bryozoa," Proc. Washington Acad. of Sc. vol. ii. (1900) p. 326; Calvet, Bry. Mar. de Cette, p. 44 (1902); Hamburg. Magalh. Sam, Bry. p. 25 (1904); Expéd. Sc. 'Travailleur' et 'Talisman,' vol. viii. (1907) p. 415; Robertson, Incr. Chil. Bry. p. 289, pl. 19. figs. 43–45 (1908).

Hippothoa hyalina, Waters, "Bry. from Franz Josef Land," Journ. Linn. Soc., Zool. vol. xxviii. (1900) p. 70, pl. 8. figs. 16–18; "Bry. from Chatham Island," Ann. Mag. Nat. Hist. ser. 7, vol. xvii. (1906) p. 19; Norman, "Nat. Hist. Finmark," Ann. Mag. Nat. Hist. ser. 7, vol. xii. (1903) p. 108; Nordgaard, Hydr. & Biol. of the Norwegian Fiords, p. 165 (1905); Kluge, "Erg. üb. die von der Olga gesamm. Bry.," Biol. Anst. auf Helgoland, vol. viii. (1906) p. 39; Levinsen, Morph. & Syst. Studies on Cheil. Bry. p. 276 (1909); Osburn, Bry. of Woods Hole, p. 235, pl. 24. fig. 47 (1912); Sumner, Osburn & Coles, "Biol. Survey of the Waters of Woods Hole," Bull. Bur. of Fisheries, vol. xxxi. (1913) p. 603.

Celleporella hyalina, Norman, Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. (1894) p. 129; Bidenkap, "Bry. von Ost Spitzbergen," Zool. Jahrb. vol. x. (1897–8) p. 621; "Bry.," Anstalt Helgoland, vol. iv. (1900) p. 252; "Bry. von Spitzbergen und König Karls Land," Fauna Arct. vol. i. (1900) p. 512; "Forteg. ov. de Arkt. Bry.," Bergens Mus. Aarbog, 1905, No. 9, p. 18.

There is one small colony growing on the seaweed with *Amathia*.

Loc. Fairly cosmopolitan from both hemispheres, occurring from tide-levels to over 2000 metres. Cape Verde Islands, collected by Crossland.

ARTHROPOMA CECILII (*Audouin*), *Levinsen*.

Waters, "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 508.

Schizoporella Cecilii, Robertson, "The Incrusting Bryozoa of the W. Coast of N. America," Univ. of California Pub. in Zool. vol. iv. (1908) p. 288, pl. 19. fig. 42.

Loc. General in the north temperate zones; Indian Ocean, Australia; Zanzibar shore (*Waters*); Red Sea; Japan; Cape Verde Islands, collected by Crossland.

CHORIZOPORA BRONGNIARTII (*Audouin*), *Hincks*.

For synonyms see Miss Jelly's Catalogue, and Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' vol. viii., Bryozoaires, p. 413, and add:—

Levinsen, Morph. & Syst. Studies on the Cheil Bry., pp. 275, 276 (1909); Angelis D. Joaquin, "Los primeros Briozoos enc. en los Depósitos Plioc. de Cataluña," Mem. de la C. y Artes de Barcelona, p. 36 (1900).

Loc. British and French coasts; Guernsey; Mediterranean; Australia; Dunedin and Foveaux Straits, New Zealand; S. Africa; Canaries; Azores; Madeira; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

SMITTINA TRISPINOSA, var. PROTECTA, *Thornely*.

Waters, "Bry. from Zanzibar," Proc. Zool. Soc. 1913, p. 513.

Loc. Gulf of Manaar (*Thornely*); Red Sea (*Waters*); Wasin, Brit E. Africa, 10 fath.; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

SMITTINA TROPICA, *Waters*.

Smittina tropica, Waters, Journ. Linn. Soc., Zool. vol. xxxi. (1913) p. 174, pl. 17. figs. 10–14.

Loc. Red Sea; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

LEPRALIA? CUCULLATA, *Busk*.

For synonyms see Waters, "Mar. Biol. of the Sudanese Red Sea, Bryozoa," Journ. Linn. Soc., Zool. vol. xxxi. (1909) p. 150. pl. 15. figs. 1–5, 10, and add:—

Schizoporella cucullata, Jullien et Calvet, Bry.prov. des Camp. de l'Hirondelle, p. 141, pl. 16. figs. 7, 7 *a* (1903); Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 415.

The opercula of specimens from the Cape Verde Islands are somewhat larger than those from the Mediterranean.

Loc. Mediterranean; Red Sea; Mazatlan; Ceylon; California; S. Africa; Azores; Iles Brancot, Cape Verde, 110–180 met. (*Calvet*); St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

LEPRALIA PERISTOMATA, *Waters*.

Lepralia peristomata, Waters, "Bry. from Madeira," Journ. Roy. Micr. Soc. 1899, p. 10, pl. 3. fig. 20; Norman, "Polyzoa of Madeira, &c.," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 305.

Lepralia Magnevilla, Busk (non Sav. et Aud.), Q. Journ. Micr. Sci. vol. viii. (1860) p. 284, pl. 31. fig. 5.

Two small tubercles can be seen on the front of the operculum towards the proximal part in the position figured by me (*loc. cit.* fig. 20). They can be examined in dried specimens in which the apertures are closed by the opercula.

In *Lepralia peristomata* the peristome entirely surrounds the aperture, whereas in *Lepralia crassimarginata*, Hincks, afterwards described by Jullien as *L. collaris*, there is only an elevation a short distance below the proximal edge of the aperture. There is, however, in *L. peristomata* a great range in the development of the peristome, as some zoœcia show hardly any, whereas in others it is much raised.

Loc. Madeira (*Busk*, *Waters*, *Norman*), 15–70 fath.; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Schizotheca fissa (*Busk*), *Hincks*.

Lepralia fissa, Busk, Q. Journ. Micr. Sc. vol. iv. (1856) p. 308, pl. 9. figs. 8–10; Waters, Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 43, pl. 11. fig. 6.

Schizotheca fissa, Hincks, Brit. Mar. Polyzoa, p. 284, pl. 41. figs. 1–3 (1880); Ann. Mag. Nat. Hist. ser. 5, vol. xix. (1887) p. 303; Neviani, "Bri. post plioc. di Spilinga," Atti d. Accad. Gioen. di Sc. Nat. in Catania, vol. ix. (1896) p. 34, fig. 17; "Bri. delle Form Plioc. e Postpl.," Bull. Soc. Geol. Ital. vol. xvii. (1898) p. 12; "Bri. neog. della Calabria," Pal. Ital. vol. vi. (1900) p. 202, pl. 18. figs. 4, 5; Calvet, "Bry. du Corse," Trav. de l'Inst. de Zool. de l'Univ. de Montpellier, ser. 2, Mém. 12, p. 25 (1902); Exp. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 429; Levinsen, Morph. & Syst. Studies on the Cheil. Bry. p. 294 (1909).

There are only one or two small pieces, and in these a number of the earliest or disk stages of the ovicell occurs, but very few completed ones; in these the "fissure" is not as large as in my British and Mediterranean specimens, but the median portion is thin. Levinsen does not deal, *in extenso*, with the genus, merely putting it in the family Reteporidæ. This has long seemed to be right, as the open ovicell is similar to those of the group of *Reteporæ* with the wide fissure as in *R. Imperati*, Busk *. The labial fissure or pore is also very well marked, and this, as I have said, is an important character of the genus.

Loc. Guernsey; Sidmouth; Plymouth; Cornwall, 30–40 fath.; Ireland; Naples; Capri; Adriatic; Corsica, St. Bonifacio, 55–77 met. (*Calvet and M. Edw.*), Bastia, 40–60 met. (*Calvet*), Bay of Cadiz, 717 met. (*Calvet*); St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Holoporella pusilla (*Smitt*), *Waters*. (Plate 2. figs. 7–9.)

Discopora albirostris, forma *pusilla*, Smitt, Floridan Bry. p. 70, pl. 12. fig. 233 (1873).

Cellepora sexspinosa, Waters, "Bry. from Madeira," Journ. R. Micr. Soc. 1899, pl. 3. fig. 12; Norman, "Poly. of Madeira," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 311.

Lepralia Watersi, Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 412, pl. 27. fig. 11.

The younger zoœcia, near the border, show six long spines, whereas the older ones have only one at each side. The ovicell is small, raised, and

* Waters, "Med. & N. Zeal. Reteporidæ," Journ. Linn. Soc., Zool. vol. xxv. (1894) p. 256.

widely open in front, and at one side of the zoœcia near the aperture there is a small acute avicularium ; in a few cases there is one on each side, with occasionally an avicularium in other positions. Generally there is no mucro to the ovicells, though in one specimen many of the ovicells are mucronate, or even might be said to support a long spinous process, and the frontal projection, as figured by Calvet, has been seen. There was no ovicell to the specimen from Madeira. The surface of the zoœcia and of the ovicell is finely granular, and there are a few large pores round the border of the zoœcia.

The aperture measures about 0·08 mm.

Loc. Florida, 9 fath. (*Smitt*) ; Madeira ; Ile Brancot, Cape Verde Is., 20–25 met. (*Calvet*) : St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Holoporella aperta (*Hincks*), *Waters*.

For localities see Waters, "Marine Fauna of Brit. E. Africa," Proc. Zool. Soc. 1913, p. 522.

There is only one small colony, growing on a piece of coal, so that no preparation could be made, but there seems no doubt as to the identity.

Loc. Singapore or Philippines ; Ceylon ; Indian Ocean ; Zanzibar and Brit. E. Africa ; Cuba ; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Microporella ciliata (*Pallas*), *Harmer*.

For localities see Waters, "Marine Fauna of Brit. E. Africa," Proc. Zool. Soc. 1913, p. 523, and for synonyms add: *Lepralia ciliata*, Barrois, Embryologie des Bryozoaires, p. 149, pl. 7. figs. 4, 6, 7, 15, 19 (1877).

Microporella ciliata, Harmer, "Morph. Cheil.," Q. Journ. Micr. Sc. vol. xlvi. (1902) p. 316; Waters, "Mar. Biol. Sudanese Red Sea," Journ. Linn. Soc., Zool. vol. xxxi. (1915) p. 443; Osburn, "Bry. of Woods Hole Region," Bull. Bur. of Fisheries, vol. xxx. (1912) p. 233; Osburn, Sumner & Cole, "Biol. Survey of the Waters of Woods Hole," Bull. Bur. of Fisheries, vol. xxxi. (1913) p. 601.

Loc. Cosmopolitan ; Cape Verde Islands, collected by Crossland.

Adeonella contorta (*Michelin*), *Waters*. (Plate 4. figs. 10–15.)

Laminopora contorta, Mich. Magasin de Zoologie, 1842, pl. 3; Waters, "On some Recent Bryozoa in d'Orbigny's Collection," Ann. Mag. Nat. Hist. ser. 7, vol. xv. (1905) p. 16.

Schizoporella contorta, Calvet, Expéd. Sc. du 'Travailleur' et du 'Talisman,' Bryozoaires, vol. viii. (1907) p. 420.

? *Gemellipora arbuscula*, Calvet, *loc. cit.* p. 426, pl. 27. figs. 16–19.

Adeonella contorta, Waters, "A Structure in *Adeonella* (*Laminopora*) *contorta*, Mich. . . . together with Remarks on Adeonidæ," Ann. Mag. Nat. Hist. ser. 8, vol. ix. (1912) p. 489, pls. 10 & 11.

A common character is frequent branching at right angles, often forming but very short branches, as figured (fig. 15) from a colony, collected by Crossland, from St. Vincent, Cape Verde Islands. In some specimens these branches

form a semispiral foliaceous growth round the main branch. The specimens under consideration, and those seen in various museums, are generally violet or red, but the colour is not mentioned by Calvet in *Gemellipora arbuscula*, nor are the frequent and short branches, but, as young and even older colonies of *A. contorta* are known without this branching, I consider that it is probably a synonym. It may be well to call attention to the fact that the Adeonidæ are nearly all darkly coloured, but specimens bleached quite white are often seen. There is an interesting specimen of *Adeona* in the British Museum quite white on the one side, though very dark on the other, it evidently having been exposed to the light.

The zoœcia are raised when quite young, but are depressed when older. There is an avicularium on one side, sometimes on both, at about the level of the oral aperture. The oral aperture is elongate with a long sinus and denticles just above the sinus. The zoœcia are small and may be entirely filled up by the embryo, which is about 0·25 mm. long, and, so far as I have seen, there is no external indication as to which are gonœcia.

The older opercula often have a raised tubercle on the front, about the middle, and sometimes there is a calcareous layer over the operculum, forming what has been incorrectly called a calcareous * operculum—from this arises the calcareous tubercle. In many of the Cheilostomata a calcareous layer may be formed over the older opercula, and this has been dealt with on page 15. It does not seem right, in any case, to speak of a calcareous operculum.

There are about 13–15 tentacles, and all the Adeonidæ examined have about this number, namely, *A. platalea*, Busk, 13; *A. polystomella*, Reuss, 16; *A. polymorpha*, Busk, 15; *A. lichenoides*, Busk, 14; *Adeonellopsis distoma*, Busk, 14–16; *A. Crosslandi*, Waters, 13–14.

In my paper on *Adeonella contorta*, on page 493, the characters are given of the group dealt with by Busk as *Adeonella*.

Loc. Evidently abundant from the Cape Verde Islands, and, as stated in my paper referred to, it appears to occur in the Red Sea; the John Adams Bank, Brazil, and ? Cape St. Vincent †, Spain; St. Vincent, Cape Verde Islands, 5–20 fath., collected by Crossland.

Crisia.

When this paper was almost finished Harmer's valuable 'Siboga' Report was published, and as I was not sure how far I agreed with him upon some

* See page 15.

† I wrote asking Mr. Kirkpatrick if there was any possibility of the British Museum specimen from "Cape St. Vincent, Spain," having come from St. Vincent, Cape Verde Is., and he kindly replied that it was 'Rattlesnake' material, purchased through a dealer, and that 5 fath. looks like offshore at Cape Verde, not St. Vincent, Spain, and that there was probably a sale catalogue mistake.

points, this genus again received further examination, confirming most of the conclusions previously arrived at.

The ovicells are generally of three forms * :—

1st. Those that are free, with the oœciostome on the dorsal surface, as *Crisia Edwardsiana*, d'Orb., *C. biciliata*, MacG., *C. howensis*, MacG., *C. kerguelensis*, Busk, *C. inflata*, Waters, *C. cuneata*, Maplestone.

2nd. Those with a pomiform ovicell, as *C. aculeata*, Hass., *C. eburnea*, Hincks (pars), *C. elongata*, Harmer (M. Ed. ?), all of which have an opening with more or less of a slit and no pronounced tube; then *C. conferta*, Busk, and *C. sertularoides*, d'Orb., have a tubular oœciostome. A funnel occurs in *C. conferta*, Busk, which in many other respects corresponds with *C. elongata*, Harmer.

3rd. There are a number with pyriform ovicells, most of which seem to have a tubular oœciostome, as *C. tubulosa*, Busk, and *C. fistulosa*, Heller, with large wide zoœcia about 0·1 mm. or more in the aperture. *C. operculata* †, Rob., *C. pacifica*, Rob., *C. maxima*, Rob., *C. pugeti*, Rob., have also elongate pyriform adnate ovicells, but the zoœcia are smaller, being about 0·07 mm.; then *C. ramosa*, Harmer, *C. Holdsworthii*, Busk, *C. eburneo-denticulata*, Smitt, *C. tenuis*, MacG., *C. cribraria*, Stimp., *C. geniculata*, M. Ed.

We can only give typical shapes of the ovicells as there is a certain amount of variation—for instance, I have *C. denticulata*, from Roscoff, sent to me by Joliet, in which there are several long ovicells (Zeppelin form) almost tapering at the end (see Busk, Cat. Mar. Poly. pt. iii. pl. 4. figs. 2, 3), whereas from the same colonies there is one with a shorter ovicell and flattened distal end. A colony of Harmer's *elongata* from the 'Siboga' Expedition shows considerable variation of the ovicells, so that they might be called pyriform, pomiform, or wider. Canu ‡ gives the photograph of the fossil *Crisia Corbini*, Canu, with a very large and wide ovicell, about double the width of the branch, with the end flat.

Jullien and Calvet § say that they consider the "formules algébroides" introduced by Smitt, and followed by Harmer, with one slight simplification, to be valueless, and these have never appealed much to me, for in description we must try and give the usual or typical characters, rather than take an individual in such a genus. However, there may be cases where such a formula may be useful, as, for instance, using it instead of an extra figure or in sending particulars to a correspondent. The formula has, however, been

* "Bry. from Zanzibar," Proc. Zool. Soc. 1914, p. 840.

† Some of Robertson's species are only judged from the figures, and this is the case with *C. tenuis*, MacG.

‡ "Bry. des Terrains Tert. des Environs de Paris," Ann. de Paléont. vol. ii. (1907) p. 104, pl. xii. fig. 6.

§ Jullien et Calvet, Bry. prov. des Camp. de l'Hirondelle, p. 109 (1903).

made unnecessarily puzzling by the use of the plus (+) sign, where plus is not really meant, for the number of zoœcia in a branch is first given, then where a new branch occurs is indicated, but this is not a plus, it is not additional, unless the subbranching zoœcia are first mentioned separately; and by putting a comma instead of the + the disconcerting "algébroide" appearance is done away with. We thus give the number of zoœcia, say 9, and show that the new branch occurs after the second zoœcia, and whether the branch is on the right or the left by the position of *r*. There is, of course, not the objection to brackets that there is to the plus, but it is more easily printed with a colon. A specimen from the Cape Verde Island collection reads :—

9, r_2 : 9, $_2r$: 12, $_2r$, × .
|
18, $_1r$, ov_3, $_3r$, r_4, × .
|
12, $_1r$, ov_3, × .

This is a piece near the growing end, whereas at the base there are a number of internodes without zoœcia, or very few, before the typical internodes are formed. The example formula only deals with three branches, while many colonies will have fifty, and for some colonies a large sheet of paper is required, though the main features of a hundred colonies might sometimes be given in a few lines. It should be noticed that the growing branch frequently contains a larger number of zoœcia than other branches. A further complication in the formula occurs in Harmer's last paper, a branch on the right has *r* and a small figure below, whereas a branch on the left has a large figure and a small *r* above, but, although it occurs throughout, it must surely be a printer's error.

In giving the measurements of the distance from zoœcia to zoœcia it, of course, must not be supposed that there is no variation, but if mature branches are taken, though not the lower zoœcia on a branch, then it will usually be found that the variation from the average is but slight.

Crisia tubulosa, *Busk*. (Plate **3**. fig. 1.)

Crisia tubulosa, Busk, Cat. Mar. Polyzoa, pt. iii. p. 7, pl. vi. A. figs. 3, 4 (1875).

In the Boa Vista specimens the zoœcial tubes expand at the end, the aperture measures about 0·12 mm., which is a trifle smaller than the British Museum specimen, and the zoœcial tube is free for a considerable extent. The ends of the zoœcia are 0·5 mm. apart, and except in the lower internodes there are more zoœcia than given by Busk, sometimes as many as 16. The branches arise from the second, third, or fourth pairs. The ovicells are elongate

pyriform, to some of which there is a tube without any funnel, but other ovicells show no tube. In the British Museum specimens there is a slight funnel. The aperture of the ovicell tube is about 0·08 mm. There is usually a branch on each side near the base of the ovicell. The bases rami are long—that is, they reach to the next zoœcium below.

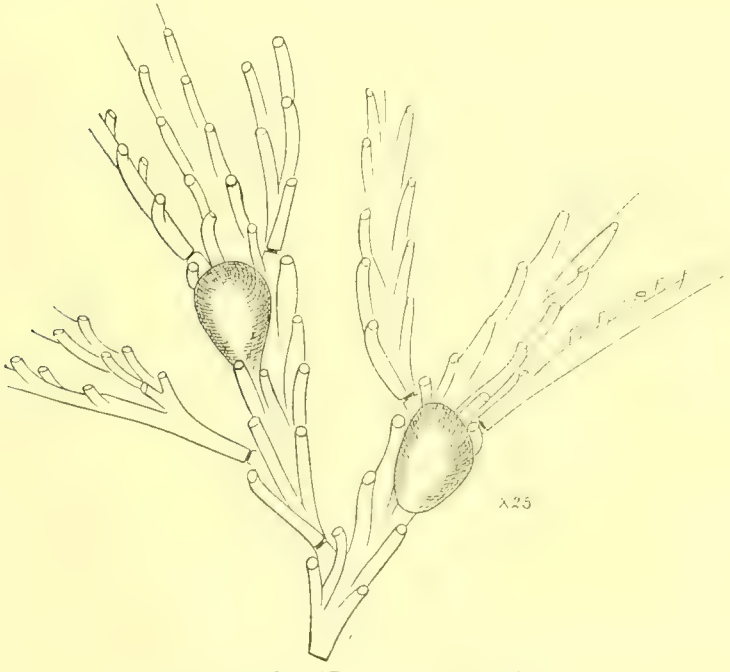
This is much like *C. pacifica**, Robertson; but from Dr. Alice Robertson's figure the distance from zoœcium to zoœcium is only about 0·33 mm., so that it is a more slender species than *tubulosa*, Busk. *C. pacifica*, Rob., *C. maxima*, Rob., *C. pugeti*, Rob., all seem closely allied.

Loc. Cape Verde Islands (*Busk*); and Boa Vista, Cape Verde Islands, collected by Crossland.

CRISIA DENTICULATA (*Lamarck*), *M. Edw.*, var. VERDENSIS, nov. (Text-fig. 2.)

There are several colonies from the Cape Verde Islands which are about 12 mm. long, forming close tufts much less straggly than is usually the case

Fig. 2.



Crisia denticulata (*Lam.*), var. *verdensis*, nov.

in *Crisia denticulata*, as the branches very soon have the mature form, and this may be the case after one short internode, whereas frequently in

* "Cyclostomatous Bryozoa of the West Coast of N. America," Univ. of California, Pub. Zool. vol. vi. (1910) p. 242, pl. 20. figs. 16, 17.

C. denticulata there are a series of short internodes before gradually becoming normal—however, this may be only a character of local importance. There are generally 7–9 zoœcia in an internode, the branches usually commence after the first or second zoœcium on that side, being alternate where there is no ovicell, with one branch to each internode, followed in the next internode by one on the other side. In the internodes with an ovicell there is usually a branch after the first zoœcium or near it, and a few zoœcia further up is the ovicell, as well as a new branch on one or both sides near to it, corresponding with the branching and ovicell described by Harmer in his *C. elongata* *. The ovicell, though not as short as in Harmer's figured specimen, is short and pomiform, but does not spread out at the distal end as much. It has a slit or oval opening in the distal end of the ovicell as described by Harmer for both *elongata* and *denticulata*.

The branches are fairly straight, with sometimes a slight sigmoid curve as may also be found in *C. denticulata*. The zoœcial aperture is about 0·06 mm., the distance from zoœcium to zoœcium is about 0·26 mm., the joints are black. The denticle on the outer side of the zoœcium is a most inconstant character in this and other species, for some internodes may have it strongly marked, while it is quite absent in others.

It would seem that round *denticulata* † we have a group including probably *C. acropora*, Busk, *C. sinclairensis*, Busk, *C. elongata*, M. Edw., *C. elongata*, Harmer, *C. serrata*, Waters. Whether we consider them as species or varieties I cannot think that the form I figured as *C. elongata* ‡, believing it to be the form described by Milne Edwards, is less entitled to a distinct position than the others. Its internodes are remarkably straight, whereas Harmer describes his as usually with a sigmoid curve. I suppose that about 100 internodes of the form figured were examined, all straight and long with numerous zoœcia, and only one branch growing near the distal end. The base of the branches, both main and lateral, of the Zanzibar *elongata* is very broad, about 0·13 mm., but as this is not much broader than in *C. denticulata* much importance cannot be attached to it. In my paper "On some Species of *Crisia*," § I have referred in more detail to Harmer's *C. elongata*, and indicated that two

* "Polyzoa of the 'Siboga' Expedition," Ent., Ctenost. & Cyclos. p. 96 (1915).

† The specimen of *C. denticulata* in the 'Challenger' collection from St. Paul's Rock, Chall. Rep. Polyzoa, Pt. II., p. 4, pl. 2. fig. 3, has short ovicells without any tubular oœciostome, the lower joints are black, and it is somewhat like Harmer's *C. elongata*. The specimen from Macclesfield Island, Tristan Da Cunha, has the joints light, the basis rami is not wedged in, and it does not seem to be *denticulata*. The specimen from Cape York has fairly straight internodes with the branches placed high, and is not unlike my *C. elongata*.

‡ "Bry. from Zanzibar," Proc. Zool. Soc. 1914, pl. 1. figs. 3, 4 (1915), and see Ann. Mag. Nat. Hist. ser. 8, vol. xviii. (1916) p. 474.

§ Ann. Mag. Nat. Hist. ser. 8, vol. xviii. (1916) p. 474.

queried specimens may have influenced him to make a comparison with my *elongata*.

The variety *verdensis* has comparatively short regular internodes, few branches in the internodes where there is no ovicell, black joints, base of branch about 0·08 mm., most of the bases rami are wedged in, while others are longer ; though, as some of these characters may not be very important, *verdensis* and *elongata* may be moderately closely allied. On the other hand, the Cape Verde Islands specimens of *verdensis* are much like *C. sinclairensis*, Busk. At any rate, *verdensis* has not the long straight internodes with one branch to each, as in what Busk and I have considered to be *elongata*, M. Edw.

Loc. Boa Vista, Cape Verde Islands, 5–20 fath., collected by Crossland.

Crisia sigmoidea, *Waters*.

Crisia sigmoidea, Waters, Ann. Mag. Nat. Hist. ser. 8, vol. xviii. (1916) p. 476, pl. 16. figs. 9, 10.

Crisia denticulata, Waters, "Bry. of the Bay of Naples," Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 269, pl. 23. fig. 2.

There is one piece, from the Crossland Cape Verde collection, which I think is this species. The zoarium is broad, with the ends of the zoœcia free projecting upwards, the ends of the zoœcia are about 0·28 mm. apart, and the zoœcial apertures are about 0·06–0·07 mm. wide. The joints are light, and the base of a branch is about 0·1 mm. wide, occurring after the second or third zoœcium on that side, with another branch on the other side a few zoœcia further up. Unfortunately there is no ovicell, and the *C. sigmoidea* and *C. conferta*, Busk, are very similar, so that without an ovicell determination is difficult, but the type-specimen of *C. conferta* is slightly wider than *C. sigmoidea* and at the same time the basis rami is wider, being about 0·13 mm. in *conferta*. The ovicells of the Mediterranean *sigmoidea* do not show any tubular oœciostome, whereas the funnel-shaped oœciostome is very marked in *conferta*.

This differs from *C. denticulata* and the *C. elongata*, Harmer, in having light joints, but the position of the branches is very similar to Harmer's *elongata*.

Loc. Naples, Rapallo, Villefranche-sur-Mer, Oran (Algiers). Cape Verde Islands, collected by Crossland.

Crisia vincentensis, sp. nov. (Plate 3. figs. 2, 3.)

This is a form which has been difficult to place, for although there are several small specimens an ovicell was only found in one case, and of such an unusual form as to raise the question as to whether it is abnormal. It is broad throughout, as though two zoœcia might have been forming ovicells

which became agglomerated. At first it was thought to be *C. eburnea*, and probably the variety *laxa*, Busk.

The lower branches usually start from below the aperture of the first zoœcium—that is, from the side of the first zoœcium,—while in older parts the new branch arises above the aperture of the first zoœcium. In *C. eburnea*, Hincks, there is some irregularity as to the branches starting from the first or second zoœcium, though it is most frequently from the first.

In *C. vincentensis* there are usually 7 zoœcia in an internode, the zoœcial aperture is 0·05–0·06 mm., the oœciopore is 0·03 mm. without any funnel; the branches are about 0·12 mm. wide, the distance from zoœcium to zoœcium is about 0·26 mm., the base of a new branch is about 0·07 mm., and the joints are light. The basis rami differs from that of *C. eburnea* in being longer, sometimes reaching to the next zoœcium, or it may stop a little short of this, whereas generally the basis rami in *eburnea* is short with what I should call the graft character. A 'Challenger' specimen of *C. eburnea*, var. *laxa*, in the British Museum from the Busk collection has a large, long, adnate ovicell much raised at the distal end with the oœciostome contracted, so that it is much wider than deep as in the *C. eburneo-denticulata* figured by me * from West Greenland, and on this account the present form is not placed under *laxa*.

Harmer †, with a query, places *C. eburnea*, var. *laxa*, as a synonym of *C. kerguelensis*, Busk, but the specimen alluded to in the British Museum, with the attached ovicell, proves that it is not the *C. kerguelensis*, which Harmer figures with a free ovicell, having a tubular oœciostome on the dorsal surface.

A new name is given with considerable hesitation to the present Cape Verde specimens.

C. vincentensis has about 12 pores in each square 0·1 mm., *C. eburnea* and *C. fistulosa* have fewer, *C. ramosa* about 5.

TUBULIPORA PULCHRA, *MacGillivray*, var. nov. (Plate **3**. figs. 8, 9.)

Tubulipora pulchra, MacG., "Descr. of new or little-known Polyzoa," pt. vii. Trans. & Proc. R. Soc. Vict. vol. xxi. (1885) p. 95, pl. 2. fig. 1; Robertson, "Cyclost. Bry.," Univ. of California, Pub. Zool. vol. vi. (1910) p. 250, pl. 23. figs. 32–35.

Tubulipora fimbria, var. *pulchra*, Waters, Ann. Mag. Nat. Hist. ser. 5, vol. xx. (1887 p. 258, pl. 7. figs. 1–3.

The Cape Verde Islands specimens have the zoœcial tube much larger (0·14 mm.) than those from Port Jackson, Australia (0·7 mm.), and it may be necessary to consider them as a variety. Apparently the specimens examined by Dr. Alice Robertson are coarser than those from Australia, but not so large as the present form.

* Ann. Mag. Nat. Hist. ser. 8, vol. xviii. (1916) pl. 16. figs. 4, 5.

† "Polyzoa of the 'Siboga' Expedition," Ent., Ctenost. & Cyclost. p. 105 (1915).

In the colonies from the Cape Verde Islands the young branches are narrow with only a few zoœcia and frequently anastomose, though ultimately forming a wide spreading growth. They have evidently grown on a calcareous seaweed. *T. organizans*, d'Orb., sent to me by Jullien from Cape Horn, has similar attachments, and Harmer mentions them in *T. plumosa*, W. Thomp. It is possible that the species under consideration should be called *T. organizans*, d'Orb.

Loc. Victoria (*MacGillivray*), Port Jackson (*Waters*); Southern California, San Diego shore, 11–32 fath. (*Robertson*); St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

Tubulipora Lamourouxii (*Audouin & Savigny*), *Waters*. (Plate 3. figs. 4, 5, 6, 10, 11.)

Proboscina Lamourouxii, Aud., "Descrip. de l'Egypte," Hist. Nat. p. 236, pl. 6. fig. 5 (1826).

This occurs as a narrow band, with very long zoœcia on each side, showing a certain amount of regularity as in *Idmonea*, or it may spread in opposite directions with two oval subcolonies (figs. 4 *a* & 10 *a*), or even spread out in a flabelliform manner, and in one of these the ovicell has a distinct purple colour in the dry state, so that at first it was taken for *T. liliacea* (Pall.), Harmer.

The zoœcia are very exceptionally small, having the aperture about 0·5 mm., and the projecting portion of the zoœcial tubes show no pores. The ovicell is central, forming a raised inflation with a simple oœciostome tube, about 0·03 mm. The dorsal surface is very characteristic, having raised ridges curved from the median line, and along these ridges there is a row of small pores for the attachment (fig. 5).

No *Tubulipora* has been described with so small an oœciostome tube, and in all the cases referred to by Harmer, with the exception of *T. flabellaris*, Fabr., the oœciopore is larger than the zoœcial orifice, whereas here it is smaller. Harmer * says the oœciostome in *T. liliacea* is larger than the orifice of a zoœcium, mentioning *T. phalangea*, Couch, as about the same size, in *T. aperta*, Harmer, as larger than the zoœcial orifice, in *T. plumosa*, W. Thomp., as also larger, while in *T. flabellaris* it is somewhat less than the diameter of the zoœcial orifice. Dr. A. Robertson † says that the oœciostome in *T. occidentalis* is smaller than the aperture of a zoœcium.

I met with a few cases of some very delicate tubes, three or four starting from near the same centre, and these were taken at first for an unknown form (Pl. 3, fig. 7 juv.), but some young forms of *T. Lamourouxii*, with primary, convinced me that young forms with long erect tubes give much

* "On the Development of *Tubulipora*," Quart. Journ. Micr. Sc. vol. xli. n. s. p. 91.

† "Cycl. Bry. of the West Coast of N. America," Univ. of California, Pub. Zool. vol. vi. (1910) p. 249, pl. 22. figs. 29–31.

this appearance. Looking down on the tubes they are so much foreshortened that it is impossible to give satisfactory figures, and this remark applies also to the oœciostomes of fig. 4.

The discovery of this species, placed by Audouin in his genus *Proboscina*, a name adopted for a genus by d'Orbigny and others, is most important, for some authors, especially paleontologists, have considered that in the Stomatoporidæ, *Stomatopora* should be used for uniserial adnate forms, while *Proboscina* would include multiserial adnate forms. Undoubtedly the name *Proboscina* will have to be entirely dropped, and, while I think that *Stomatopora* will have to include many forms which are more or less multiserial, and that some things described as *Proboscina* will fall into *Tubulipora*, I am not prepared to state that all will find their places in these two genera; however, if a generic division is required for many now known as *Proboscina* there is the genus *Criserpia* * of H. Milne Edwards in which these can find a home †. Milne Edwards proposed to place all the known Cyclostomata in the "family" Tubuliporidæ, but we now see that many families as now understood were included, though until we understand more about the most important genus *Stomatopora* both as to its primary attachment and ovicells we cannot speak with any certainty concerning the group in question.

Miss Jelly and others have considered that Savigny's figures of *Proboscina Boryi* and *P. Lamourouxii* represented the same species, but in this I cannot agree, for in the figures the difference in size of the zoœcia is very marked.

Loc. Savigny's specimens were probably from the Red Sea or Mediterranean; St. Vincent Harbour, Cape Verde Islands, 10 fath., collected by Crossland.

TUBULIPORA INCRASSATA (*Smitt*), *Waters*. (Plate 3. fig. 7.)

Proboscina incrassata, Smitt, "Krit. Fört. öfver Skand. Hafs-Bry." Öfv. Kongl. Vetensk.-Ak. Förh. 1866, pp. 402, 458, pl. 5.

Tubulipora incrassata, Waters, "Bry. of the Bay of Naples," Ann. Mag. Nat. Hist. ser. 5, vol. iii. (1879) p. 272.

? *Proboscina Boryi*, Aud., Descrip. de l'Egypte, Hist. Nat. p. 236, pl. 6. fig. 4 (1826).

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* "Mémoire sur les Crisies," &c., Ann. Sci. Nat. 2me sér., Zool. ix. (1838) pp. 193–238. The importance of this paper has not always been fully appreciated, for here the Cyclostomata were divided from the Cheilostomata, though under other names, and since then there has been much elaboration. Audouin and Milne Edwards,[1] in 1828, separated the Bryozoa as "family" 4, meaning by this what we should now call a class. Although several zoologists had, for many years, realized that a separation of zoophytes should be made, they were the first to make it. To have shown not only that there was this class, but also to have realized the large divisions of Cheilostomata and Cyclostomata shows what good pioneer work Milne Edwards gave us.

[[1] Audouin et Milne Edwards, "Résumé des recherches sur les animaux sans vertèbres faites aux îles Chausey," Ann. Sci. Nat. vol. xv. (1828) p. 18.]

† Ann. Sci. Nat. vol. xv. (1828) p. 41.

There are some specimens of *Tubulipora* growing irregularly in a band-like form, with large zoœcia, the zoœcial aperture being about 0·14 mm., whereas in *T. Lamourouxii* the aperture is only about 0·05 mm. A young specimen of *T. Lamourouxii* (Pl. 3. fig. 7, juv.), growing on the present species shows the great difference in size. There are in the interior of the zoœcia a few pin-head spines, and in one zoœcium, not very far down, there is a row of short teeth. In a specimen from Naples there is an anterior ovicell spreading among several zoœcia, with a short tubular oœciostome, about the same diameter as a zoœcium, without any funnel.

I do not consider that the *Stomatopora incrassata*, Hincks, is the *Tubulipora* (*Proboscina*) *incrassata*, Smitt, nor am I sure that the form described by Smitt in 1871 * is the same species as he originally described. Without a considerable amount of material it is difficult to decide whether to provisionally retain Smitt's name or to give a new one, as it is evident that there has been some confusion. D'Orbigny first gave the name without figures, and the description is insufficient.

There is a certain amount of resemblance to *Filisparsa tubulosa*, Busk, from Naples, which, however, grows free or only very slightly attached, and has an oœciostome with one axis, usually the transverse, much the longer, with an irregular funnel as in *T. aperta*, Harmer. The zoarium spreads out slightly towards the distal end without being flabelliform, and although the zoarium does not expand as much as in Harmer's specimens, it would seem to be the same as *aperta*. Harmer, in his 'Siboga' Report, p. 143, says that *T. aperta* may possibly be the *Hornera tubulosa*, Busk.

Loc. Naples. St. Vincent Harbour, Cape Verde Islands, on clinkers, collected by Crossland.

LICHENOPORA IRREGULARIS (*Johnson*), *Norman*. (Pl. 4. figs. 2, 3, 5, 6, 7, 8.)

Radiopora irregularis, J. Yate Johnson, "Cyclost. Bry. from Madeira," Ann. Mag. Nat. Hist. ser. 6, vol. xx. (1897) p. 63.

Lichenopora irregularis, Norman, "Poly. of Madeira and neigh. Islands," Journ. Linn. Soc., Zool. vol. xxx. (1909) p. 282.

There are several zoaria growing on a large stone, brought up by a diver from off St. Vincent, Cape Verde Islands, and a small piece on a clinker from St. Vincent Harbour.

The very thin lamella is closely attached to the stone, and is more or less circular, quite independent of the outline of the subcolonies; the central subcolony is circular or oval, while the outer ones are lobulate or often form "subtriangular lobes" with uniserial zoœcia, and in these uniserial forms ovicells have been found. There are also various similar colonies, which from their general appearance seem as if they should be united, but they have bi-multiserial rays throughout the colony (Pl. 4. fig. 1) with subcolonies

* Öfvers. Kongl. Vetensk.-Ak. Förh. 1871, p. 1119.

somewhat larger than those of the uniserial forms (figs. 2, 8), and this bi-multiserial form is provisionally called var. *composita*.

Returning to the uniserial forms it is in these that the ovicells have been found, and the zoarial growth is similar to that of *Radiopora Francquana*, d'Orb.*

The central depressed region of each subcolony has large pores (about 0·07 mm.) about the size of those of the zoœcia, whereas the pores between the rays are usually smaller. The inner zoœcia of a ray are the most raised, whereas in var. *composita* there is very little difference—in fact, most seem cut off nearly straight, without being apparently worn ; in this uniserial form the zoœcia are well raised, and especially near the edge of the colony the spinous processes are more pronounced than in the variety. In the British Museum specimen from Madeira †, in the Norman collection, most of the zoœcia show a blunt spinous process at the outer border and occasionally on both the inner and outer, also the internal pin-head spines in the cancelli are very small and rather rare. In one colony, from Cape Verde Islands, there are two ovicells, which are very narrow and interdigitate in narrow bands between the rays (figs. 2, 6). The surface of the ovicell has numerous fine perforations. Another colony has a very deep pit in the centre of several of the subcolonies (fig. 5), but, on carefully focussing to the base of one pit, the narrow bands of a similar ovicell are seen, so that we are looking upon the upper part of an ovicell now at the bottom of this pit, and a zoarial growth must have taken place subsequent to the formation of the ovicell, but whether it indicates a regular second layer it is impossible to say. In one zoarium, in the centre of a subcolony, the base is found of an ovicell in formation, which is smooth and imperforate, proving that in the case previously mentioned we were not looking on the base of an ovicell at the bottom of the pit. In the section of another *Lichenopora* I have seen an ovicell in two stories—that is, one ovicell above another.

Harmer ‡ describes and figures a similar ovicell in what he calls *Lichenopora novæ-zelandiæ*, Busk, but it is unfortunate that he should have taken the name *novæ-zelandiæ* apparently because it was published a page sooner than *L. Holdsworthii*, Busk, for this latter is well described from characteristic specimens found in Ceylon. On the other hand, the description and figure of *novæ-zelandiæ* were not very satisfactory, and among the specimens which Busk so named in his collection there seem to be more than one species. I have some specimens which have always seemed to me to be this species, and one from New Zealand was sent to me so determined, also the British Museum specimens have been looked through more than once,

* Pal. Franç. pl. 782. figs. 3–8.

† In one case the ovicell only throws out arms on one side of the subcolony. There are some deep pits as described in the Cape Verde Islands specimens.

‡ Polyzoa of the 'Siboga' Expedition, pt. i. p. 155, pl. 12. fig. 11 (1915).

without finding reason for change of opinion. Apparently Busk did not figure the specimen he was describing—in fact, the figure is from a badly preserved specimen; whereas he had in his collection specimens, so named, of what I have identified as *L. novæ-zelandiæ*. It is a small form in which the zoœcial tubes of the much raised inner zoœcia of the rays meet or nearly meet in the centre, forming when there is no ovicell a very depressed inverted cone. These have a raised flat ovicell * over the centre with most minute perforations and a bordering ridge; besides the cancelli are frequently formed with bars across, as in *L. radiata*, Hincks, and, although there are some "pin-head" spines in the cancelli and zoœcia, they are not very frequent, whereas in *L. Holdsworthii* the round cancelli are very regular, with very numerous large pin-head spines. In my specimens of *L. Holdsworthii*, in two cases, there are hollow grooves in the interradial spaces, and in other places on the central wall, which seem to relate to the formation of an ovicell such as that figured by Harmer (*loc. cit.* fig. 11).

I have a large number of *Lichenoporæ* with ovicells, and, when writing my short paper † on them, much time was spent in comparing the Natural History Museum types and specimens. Since then I have had some additions to my collection, and the Museum has received several valuable collections, such as Busk's and Hincks's, but on the whole it seems that what I then said is supported. My paper was written at a time when hardly anyone took any notice of the ovicells, in fact they were generally ignored; but certain types of ovicells were indicated, and whether the identifications will ultimately stand was a matter of secondary importance, though I am unaware of any reasons for changing the names then used. I showed that there was the flat type of ovicell as in *L. novæ-zelandiæ*, the raised, rounded, dome-shaped type with trabeculæ over the wall as in *L. echinata*, McG., and *L. victoriensis*, Waters, and, lastly, the ovicell spreading up to the rays as in *L. californica* (Busk) Waters. I stated that this should be considered as the species of Busk, as there was some doubt as to d'Orbigny's description, and Harmer, in calling attention to the biserial rays of Busk not being indicated by d'Orbigny, does not seem to have remembered what I had already said. However, the question of uncertainty through Busk's species being bi- to multiserial has no importance now, as I have a specimen from Western Port, Victoria, with uniserial rays and an ovicell as figured ‡ by me, and another from the same locality with biserial rays and a similar ovicell. The question of uni- and biserial rays has not only broken down

* "Bry. New South Wales, etc.," Ann. Mag. Nat. Hist. ser. 5, vol. xx. (1887) pl. 7. fig. 8.

† "On the Ovicells of some *Lichenoporæ*," Journ. Linn. Soc., Zool. vol. xx. (1888) pp. 280–285.

‡ "Bry. New South Wales, etc.," *l. c.* p. 261, pl. 7. fig. 8.

as a generic character, but also in several cases as a specific one. All the same the *Lichenoporæ* have yet to be brought into order, and to do this we require more spirit-specimens; but to place as synonyms what I considered as *L. novæ-zelandiæ*, Busk, *L. Holdsworthii*, Busk, and *L. victoriensis*, Waters, does indeed seem retrograde. Harmer's 'Siboga' specimens must be called *L. Holdsworthii*, Busk *.

Since I wrote on the ovicells, among others, two specimens from Ceylon, named by Busk *L. Holdsworthii*, have been added to the National Collection. The central part is somewhat depressed with an ovicellular wall covering it, and the rays extend into the ovicell; by the side of this there is an oœciostome tube, and on one of the specimens at a higher level there is an ovicell spreading in and out between the rays.

These Cape Verde specimens of *L. irregularis* are not, as Norman supposed, what I called *Radiopora pustulosa* †, d'Orb., from Naples, each subcolony of which has some multiserial and some uniserial rays, and the subcolonies are much larger than those of the Cape Verde Island forms. The specimens alluded to, from Naples, are not closely attached, nor were Peach's *L. meandrina*. Although unable to see any material difference between the recent and fossil *R. pustulosa*, there is some uncertainty in identifying a fossil about which we know little, and therefore it would have been a safer course to have named the recent one *L. neapolitana*, as it does not seem to be the same as *L. hispida*, Flem. The specimens of *L. meandrina*, Peach, in the Nat. Hist. Museum from Busk's and Hincks's collections, have much smaller subcolonies than what I called *pustulosa*, d'Orb., and the zoœcia are 0·07–0·08 mm., while the cancelli are about 0·06 mm.—that is, smaller than in *pustulosa*, where they are about 0·1 mm., with the zoœcia about 0·09 mm.

In the Museum specimen of "*meandrina*" the subcolonies are often very elongate, instead of circular, and there are more definite serial ridges than in the solitary *L. hispida*, Flem., and we may certainly doubt the advisability of considering the composite form a variety of *hispida*. Peach's figure and description of *L. meandrina* correspond more with the Mediterranean *pustulosa* than do the Museum specimens, which are not from Peach's collection. However, I think we have as separate species *L. irregularis*, Johns., *L. pustulosa*, d'Orb. (Waters), and *L. meandrina*, Peach. The ovicells are unknown in the last two species. Other composite species are *L. pristis*‡, MacG., *L. magnifica*, MacG., *L. bullata*, MacG., and several fossil ones are known as *L.* (*Radiopora*) *formosa*§, d'Orb., *L.* (*Radiopora*) *Francquana*‖, d'Orb.,

* There is, however, a small specimen from between Nusa Besi and N.E. point of Timor (St. 282) with long erect biserial rays, which may almost be said to be small bundles of rays, and the central zoœcia are very irregular. This I cannot consider to be the same species as the other so-called *novæ-zelandiæ*.

† Pal. Franç. pl. 649. figs. 1–4.
Pal. Franç. pl. 782. figs. 1, 2.

‡ Trans. Roy. Soc. Vict. vol. xx. (1883) p. 126.

‖ Pal. Franç. pl. 782. figs. 3–8,

L. (*Radiopora*) *multistellata* *, d'Orb., *L. conjuncta* †, Mich., *L. cumulata* ‡, Mich., *L.* (*Multitubigera*) *micropora* §, Reuss, *L.* (*Multitubigera*) *gregaria* ‖, d'Orb., *L. suecica* ¶, Hennig.

The early stage of *Lichenopora* is flabelliform and is like that of *Tubulipora* (say, *flabellaris*, Fabr.), but it soon completes the circle and then the flabelliform growth can only be seen by examining the under side. Now clearly in a colony of *L. irregularis*, *L. meandrina*, and *L. pristis* there is only one primary, and the new subcolonies may be said to bud out from the older ones (see figs. 1, 2, 3, 4, 5), and this requires further study with sections. It does not seem strictly correct to speak of these as confluent, as is usually done. There are also many cases of *Lichenopora* where the two colonial disks partially coalesce : for instance, I have specimens of *L. verrucaria* where the touching lamina of two disks form one growth, as well as some of the adjacent zoœcia uniting. In *Lichenopora boletiformis* **, d'Orb., we find the same thing, and also one colony growing on the top of another, which also occurs in many other cases—as, for example, *Discosparsa marginata*, d'Orb. *Lichenopora* with multiserial rays was separated from *Discocavea* with uniserial rays, but most recent workers have recognized that the difference of the rays cannot be retained as a generic character, though usually useful specifically, while some both of the confluent and simple species show that even specifically the character may not always be of value. The type is *Lichenopora turbinata* ††, Defrance, also photographed by Canu ‡‡, which, although with but a small attachment, has been considered by Pergens and Canu to belong to *Lichenopora* as now generally understood. As described by d'Orbigny and by Canu *L. turbinata* has cancelli. *Lichenopora* is not the only genus which forms round disks, and there are a number with the zoœcia radiating in bundles without pores between the rays. Many of these have been called *Defrancia*, others *Actinopora*, *Apsendesia*, *Pelagia*, &c. These Gregory §§ would place partly in *Lichenopora* (having removed what has so long been considered *Lichenopora* to *Discocavea*) and partly under *Apsendesia*, considering that *Pelagia clypeata*, Lamx., was the same species as *Apsendesia cristata*, Lamx.,

* Pal. Franç. pl. 649. figs. 5–7.

† Michelin, Icon. Zooph. p. 277, pl. 63. fig. 16 (1840-7).

‡ *Loc. cit.* p. 319, pl. 77. fig. 1.

§ Reuss, "Anth. & Bry. von Crosaro," Denk. Ak. Wien, vol. xxix. (1869) p. 259, pl. 36. fig. 15.

‖ *Loc. cit.* pl. 752. figs. 9, 10.

¶ "Bry. Sver. Kritsystem," Lunds Univ. Årsskrift, vol. xxx. (1894) p. 35, pl. 2. figs. 33–36.

** Waters, "Cyclost. Bry. from Australia," Q. Journ. Geol. Soc. vol. xl. (1884) p. 695, pl. 31. figs. 20, 21.

†† Dict. Sc. Nat. vol. xxvi. p. 257, pl. 4. figs. 4, 6 (1823).

‡‡ "Bry. des terr. Tertiaires," p. 138, pl. 17. figs. 13–15, in Ann. de Paléont. (1907).

§§ "Cretaceous Bry.," Cat. Fossil Bry. in Brit. Mus. p. 247 (1909).

but from Lamouroux's figure of *cristata* nothing can be made out; however, Michelin, Haime, and Gregory have given figures of what they believed was the *Apsendesia cristata*. Haime thought that the two genera must be united, while Gregory* considers that they should be united as one species, but since *Pelagia clypeata*, Lamx., occurs, from various localities, as a complete and mature species I cannot at present accept this view. Perhaps it would be most reasonable to retain *Defrancia*, but time will show, and in this group, in all cases with which I am acquainted, the ovicell is near the border of the zoarium.

In a specimen of "*Actinopora regularis*," d'Orb., which I collected from St. Croix, Switzerland, the locality from which d'Orbigny described it, there is fortunately an ovicell extending from one ray to the next and not very large. The ovicell was not previously known, and my specimen is as good as a co-type, and shows that it is not *Lichenopora* but *Defrancia*, if this name is retained.

For a long time, while progress was being made with the classification of the Cheilostomata, that of the Cyclostomata seemed most hopeless, but now that more is being learnt about the ovicells and other characters, there is every reason to hope that the collection and study of more species will make the classification more natural.

Harmer in his 'Siboga' Report, received after the above descriptions were written, considers that *Lichenopora* should be used for what we have so long understood by this name, and Pergens, Canu, and others have expressed the same opinion.

Loc. Madeira (*Johnson*, *Norman*); St. Vincent, Cape Verde Islands, collected by Crossland per diver.

LICHENOPORA IRREGULARIS, var. COMPOSITA, var. nov. (Pl. 4. figs. 1, 4.)

This is the bi-multiserial form mentioned as occurring on the same stone as *L. irregularis*, Johnson, and about which I have been in doubt as to whether the two forms should be united as one species. The subcolonies are somewhat larger than those of the uniserial form, and the zoœcia, usually without any spines, are less raised, but otherwise they seem similar.

FLUSTRELLA HISPIDA (*Fabricius*), *Gray*.

For synonyms see Miss Jelly's Catalogue, and add:—

Flustrella hispida, Prouho, "Recherches sur la larve de la *Flustrella hispida*," Arch. de Zool. Expér. et Géner. 2nd ser. vol. viii. (1890); Robertson, "Bryozoa," Harriman Alaska Exped., Proc. Wash. Ac. Sc. vol. ii. (1900) p. 331; Nordgaard, Hydr. and Biol. Invest. in Norwegian Fiords, p. 173 (1905).

Only a very small piece was found, but it was enough for certain determination. This is widely distributed in northern seas, and is common on the

* "Jurassic Bry.," Cat. Fossil Bry. in Brit. Mus. p. 171 (1896).

British and North French coasts; and Dr. Alice Robertson reports it from California, but it has not been mentioned from the Atlantic or from the Mediterranean. Hincks describes a form from Victoria as var. *cylindrica*, but judging from my specimens from Port Phillip I should certainly not call it a variety of *F. hispida*, for it has spines regularly all round the zoœcium, which is not the case in the northern form, which also is a larger and more solid form.

Flustrella hispida has 23–27 tentacles.

Harmer * considers that the genus *Flustrella* should be retained.

Loc. Northern Seas; California; Boa Vista, Cape Verde Islands, 5–20 fath., collected by Crossland.

AMATHIA TORTUOSA, *Tenison Woods* (non *Busk*).

For synonyms see Waters, "Mar. Biol. of the Sudanese Red Sea, Bryozoa," pt. ii. p. 243, pl. 24. fig. 5 (1910).

Dr. Harmer † has doubted the determination of this species from the Sudan, perhaps partly through my figures being merely outlines. I gave three very small figures of forms believed to be three species, so that a comparison could be made of the size and position, but merely to show these characters in question.

In *Amathia* the lower parts of the zoœcia are usually connate, whereas the upper part may be more or less free, varying in appearance according to the condition of the specimen and of the mount. My figure 5 of *A. tortuosa* (also figured by MacGillivray) is depicted looking down on the top of the zoœcia when the upper part is seen separated, giving naturally a short appearance, but it was advisable to show it in this position. The length of the zoœcia from Cape Verde Island are about 0·4 mm., with the lower half of the zoœcia connate and the upper free. With regard to my figure of *A. distans*, Busk, the scale was too small for it to be possible to show the ends in detail, but it will be seen that in two or three cases projecting zoœcia are shown, and this was more distinct in the original drawings, for though taken from actual specimens the size prevented their being more than diagrammatic in most respects; the length of the zoœcia is relatively the same as figured by T. Woods ‡, and surely if he had been speaking of the length of the zoœcia he would have said the length of the cells and not of "the pair of cells," and he meant the length of the group of the pair of cells. This unfortunate sentence of T. Woods has misled several authors, but the figure does not show long cells. My determination of the Sudan and Zanzibar

* Polyzoa of the 'Siboga' Expedition, p. 40 (1915).

† Polyzoa of the 'Siboga' Expedition, Ent., Ctenos. & Cyclos. p. 68 (1915).

‡ "On the Genus *Amathia*," Trans. Proc. Roy. Soc. Victoria, vol. xvi. (1879) p. 90, fig. 6.

Amathiæ was made after prolonged comparison of the British Museum and 'Challenger' specimens, and I cannot think there is anything material to alter in what I then wrote.

In the Cape Verde Island specimens there are usually 14 pairs of zoœcia. The zoarium grows from a seaweed, and the free stolon when passing over the narrow branch of any part of the seaweed becomes attached across it, again growing free beyond it. Where the stolon is thus attached the zoœcia are arranged horizontally on each side of it, thus forming two lateral series without any sign of the spiral arrangement. From the front of the attached stolon, and in the middle of the group of zoœcia, one or two fresh erect branches arise, a mode of growth and branching quite unknown in *Amathia*, raising rather large questions

On the same seaweed were entangled pieces of *Amathia Vidovici*, Heller, but on careful separation the colonies were found to be quite distinct. The seaweed having been some time in spirit has entirely lost any colour it may have had, and resembles a figure I have before me of *Polyides rotundus*, Grev., which may by now be known by another name.

I followed MacGillivray in considering that *A. connexa*, Busk, was a synonym, although stouter; of this I am now doubtful, and in the determination of some of these spiral forms we are on rather uncertain ground. A specimen in the British Museum determined as *A. connexa* by Busk I found had the stem only 0·2 mm. diameter, which is much below Busk's measurement. *A. connexa* is the largest of these spiral forms with more or less free ends, then comes *A. tortuosa*, then *A. distans*, and there is also *A. Vidovici*, with the zoœcia much separated, but it may be the differences are not as important as now supposed. In *A. obliqua*, MacG., the ends are free, and even in *A. lendigera*, Lamx., a considerable part is often free; and while we usually find that the species with the zoœcia almost entirely connate have the two series also united, yet in *A. lendigera* the two series may sometimes be found almost unattached in the middle. We must remember that we are not quite sure what characters are of most value in *Amathia*. The Zanzibar *A. distans* has the ends of the zoœcia free as in *A. tortuosa*, and a small fragment from Sydney of what I have always considered to be *A. distans* has the zoarium and zoœcia the same size as those from Zanzibar and the ends are free.

Loc. New South Wales; Victoria; Red Sea; Cape Verde Islands, collected by Crossland.

AMATHIA VIDOVICI (*Heller*), *Waters*.

Amathia Vidovici, Waters, "Marine Fauna of Brit. East Africa and Zanzibar," Cyclos, Ctenos. & Endoprocta, Proc. Zool. Soc. London, 1914, p. 848, pl. 4. figs. 1, 2, which see for synonyms.

This is growing on the same seaweed as *A. tortuosa*, T. Woods. There are usually about 8–9 pairs of zoœcia (about 0·4 mm. long) in a short spiral near the joint, with the lower part connate, the upper part free, as in *A. tortuosa* ; and this is the rule in *A. Vidovici* from other places, but a specimen from Genoa has the zoœcia more free—in fact, some of the zoœcia near the ends of the branches are quite free. From the stem there are a few radicles with digitiform processes. The stem is about 0·14 mm. in diameter, and there is a certain amount of variation in the thickness of the stems, but the piece measured from Zanzibar must have been abnormally compressed, as most are approximately the same as the present. I find that the piece sent to me by Joliet as *Serialaria semiconvoluta*, from Roscoff, has biserial zoœcia arranged in a spiral which is longer than that of *Vidovici*, being somewhat like *A. tortuosa*, and the zoœcia are much separated, so that many are quite free, which led me to think it was a modified form of *A. Vidovici*, but there is a little uncertainty as to what it should be called. We have seen that *A. tortuosa*, Woods, *A. distans*, Busk, and *A. Vidovici* are very closely related. I have a sketch of an *Amathia* in the British Museum, from the Ægean Sea, named *Serialaria lendigera*, 91. 71. 4378, which seems to be *A. Vidovici*.

Loc. Mediterranean ; Bermuda (*Chall.*) ; Brit. East Africa ; N.E. Coast, United States ; Cape Verde Islands, collected by Crossland.

ZOOBOTRYON PELLUCIDUM, *Ehrenberg*.

For synonyms and localities see Waters "Bry. from Zanzibar," Proc. Zool. Soc. 1914 p. 849 ; and Journ. Linn. Soc., Zool. vol. xxxi. (1910) p. 243, pl. 24. figs. 12, 15.

The specimens from Boa Vista, Cape Verde Islands, correspond closely with those from Naples and the Red Sea.

As previously said, I think that *Zoobotryon* and *Bowerbankia* will have to be united. Harmer does not agree, as he thinks the zoarial characters are sufficient to warrant the separation, but the only difference is whether the branching is usually with two new branches or three, whereas in a closely allied genus, *Amathia*, there are considerably greater differences, without new genera being made. For example, *A. Wilsoni*, Kirkpatrick, an undoubted *Amathia*, has also three branches at a joint.

BOWERBANKIA PUSTULOSA (*Ellis & Sol.*) *Hincks*, var. ALTERNATA, var. nov.

Specimens from Boa Vista, growing on *Zoobotryon pellucidum*, Ehr., as well as on the supporting seaweed, and others from St. Vincent Harbour,

10 fathoms, are smaller than *B. pustulosa* *, Hincks. The stolon (0·04 mm.) is smaller, the zoœcia (0·35–0·45 mm.) are shorter, and the gizzard is about 0·07 mm. in diameter. The zoarium is usually creeping, but small pieces are free, some of which may have been attached. From the creeping stolon the zoœcia grow on the opposite sides, though not as a rule in pairs, but alternate in groups of four to ten (usually about ten) ; after a group there is a diaphragm, followed by a bare stolon for a moderate distance, and then the next group. A few branches grow at right angles to the main stolons, and then there is a diaphragm near the beginning of the new branch.

Var. ALTERNATA.

This is much like *B. gracillima* †, Hincks, but the stolon is smaller in the var. *alternata*, also the zoœcia are smaller than those of typical *pustulosa*, whereas Hincks describes his *gracillima* with larger zoœcia than those of *pustulosa*, though from his figure there does not seem to be much difference.

Wherever this may ultimately be placed, it seems safest to now call it var. *alternata*.

Loc. Boa Vista and St. Vincent Harbour, 10 fath., Cape Verde Islands, collected by Crossland.

BARENTSIA DISCRETA (*Busk*), *Kirkp.*

Ascopodaria discreta, Busk, Zool. Chall. Exp. vol. xvii. p. 44, pl. 10. figs. 6–12 (1886).

Pedicellina australis, Jullien (non Ridley), Mission Scientifique du Cap Horn, p. 13 (1888).

Barentsia discreta, Harmer, Polyzoa of the 'Siboga' Exp. p. 29, pl. 2. figs. 8, 9 (1915).

As Harmer gives full references I have struck out mine and refer to his paper for synonyms.

I have previously mentioned that the connection of the pedicel with the polypide is subject to considerable variation, sometimes the rings mentioned by Busk are seen, but in other specimens there are none. This has been confirmed by Osburn. Asajiro Oka ‡ has described *Barentsia misakiensis* as

* Harmer, in his "Polyzoa of 'Siboga,'" p. 72, has, from my figure, doubted whether I had obtained *Bowerbankia imbricata* from the Sudan (Journ. Linn. Soc., Zool. vol. xxxi. (1909) pl. 25. fig. 8). But I made sketches of the three conditions of the zoœcial chamber, and it was intended to be obvious that fig. 8 represented a zoœcium in which histolysis had quite altered the polypide, but, nevertheless, in spite of these great changes having taken place, the shape of the zoœcial chamber was not as yet at all altered. If the object had been to show a perfect zoœcium a much more detailed figure would have been drawn, and certainly a little further explanation on my part would have avoided false conclusions. The figure merely represents any typical *B. imbricata*.

† Hincks, Brit. Mar. Poly. p. 525, pl. 75. fig. 6 (1880).

‡ "Sur la *Barentsia misakiensis*," Zoolog. Magazine, Tokyo, 1895, pp. 76–86, pl. 12. figs. 1–8.

closely allied to *Barentsia discreta*, which he, however, distinguishes by the number of tentacles, his species having 20–24, whereas Busk describes *B. discreta* as having 16–20 ; it, however, seems doubtful whether they should be separated, and Harmer also unites the two species.

Loc. Tristan da Cunha, 100–150 fath. (*Busk*) ; China Seas, 27 fath. (*Kirkpatrick*) ; Ceylon, India, Chile, Cape Horn, 40 met. (*Jullien*) ; Vineyard Sound and Buzzard Bay, Beaufort, N.C., and Tortugas Isl., Florida, 18 fath. (*Osburn*) ; 5° 28′ S.–134° 53′ E., 57 met. ; 1° 42′ S.–130° 47′ E., 32 met. ; Makassar, 0–32 met. ; Saleyer, 0–36 met. (*Harmer*) ; St. Vincent Harbour, Cape Verde Islands, from under stones, collected by Crossland.

PEDICELLINA CERNUA (*Pallas*), *Smitt.*

For synonyms see Miss Jelly's Catalogue, and add :—

Uljanin, "Anat. & Entw. Gesch. der *Pedicellina*," Bull. Soc. Imp. de Natur. de Moscou, 1870, pls. 5, 6; Harmer, "Life-Hist. of *Pedicellina*," Q. Journ. Micr. Sc. 1886, p. 239; Jullien, Mission du Cap Horn, Bryozoaires, p. 9 (1888); Seeliger, "Ungesch. Verm der Endoproct. Bry.," Zeit. Wissen. Zool. vol. xlix. (1889) pls. 9, 10; Levinsen, Zool. Danica, 'Mosdyr,' vol. iv. p. 96, pl. 9. figs. 18–29 (1894); Calvet, "Bry. Mar. de la Reg. de Cette," Trav. Inst. Zool. de l'Univ. de Montpellier, ser. 2, mém. 11, p. 94 (1902); Jull. & Calvet, Bry. prov. des Camp. de l'Hirondelle, p. 25 (1903); Norman, "Nat. Hist. East Finmark," Ann. Mag. Nat. Hist. ser. 7, vol. xi. (1903) p. 574; Osburn, "Bry. of Woods Hole Reg.," Bull. Bur. of Fisheries, vol. xxx. (1912) p. 213, pl. 18. figs. 3 *a–d*; Osburn, "Bry. of Tortugas Isl., Florida," Pub. Carnegie Inst. p. 185 (1914).

The specimens on *Scrupocellaria Bertholetti*, Hincks, from St. Vincent, Cape Verde, are about 0·4 mm. long, whereas British forms in my collection are about 1·6–2 mm. long.

Loc. Northern Seas ; British and French coasts, Mediterranean, Australia (*Kirkpatrick*) ; Senegal, Gulf of Guinea, Liberia, Egypt, Smyrna (*Jullien & Calvet*) ; Canary Islands (*Jullien*) ; Woods Hole Region (*Coburn*) ; Cape Verde Islands (*Jullien & Calvet*) ; St. Vincent, Cape Verde Islands, collected by Crossland.

EXPLANATION OF THE PLATES.

PLATE 1.

Fig. 1. *Bugula dentata*, × 25. The tissues drawn dark are coloured a dark blue, and this coloration is specially marked in the growing tissue and tips of the tentacles.

2. *Beania hirtissima*, × 25. Dorsal surface.

3. *Scrupocellaria Macandrei*. (*a*) Operculum, × 250; (*b*) seta, × 85; (*c*) base of seta, × 250; (*d*) mandible of lateral avicularium, × 250; (*e*) mandible of anterior avicularium, × 250.

4. Do. do. Avicularian chamber decalcified, × 250.

5. Do. do. Base of seta with muscles and lateral chitin pieces (*ch.*), × 250.

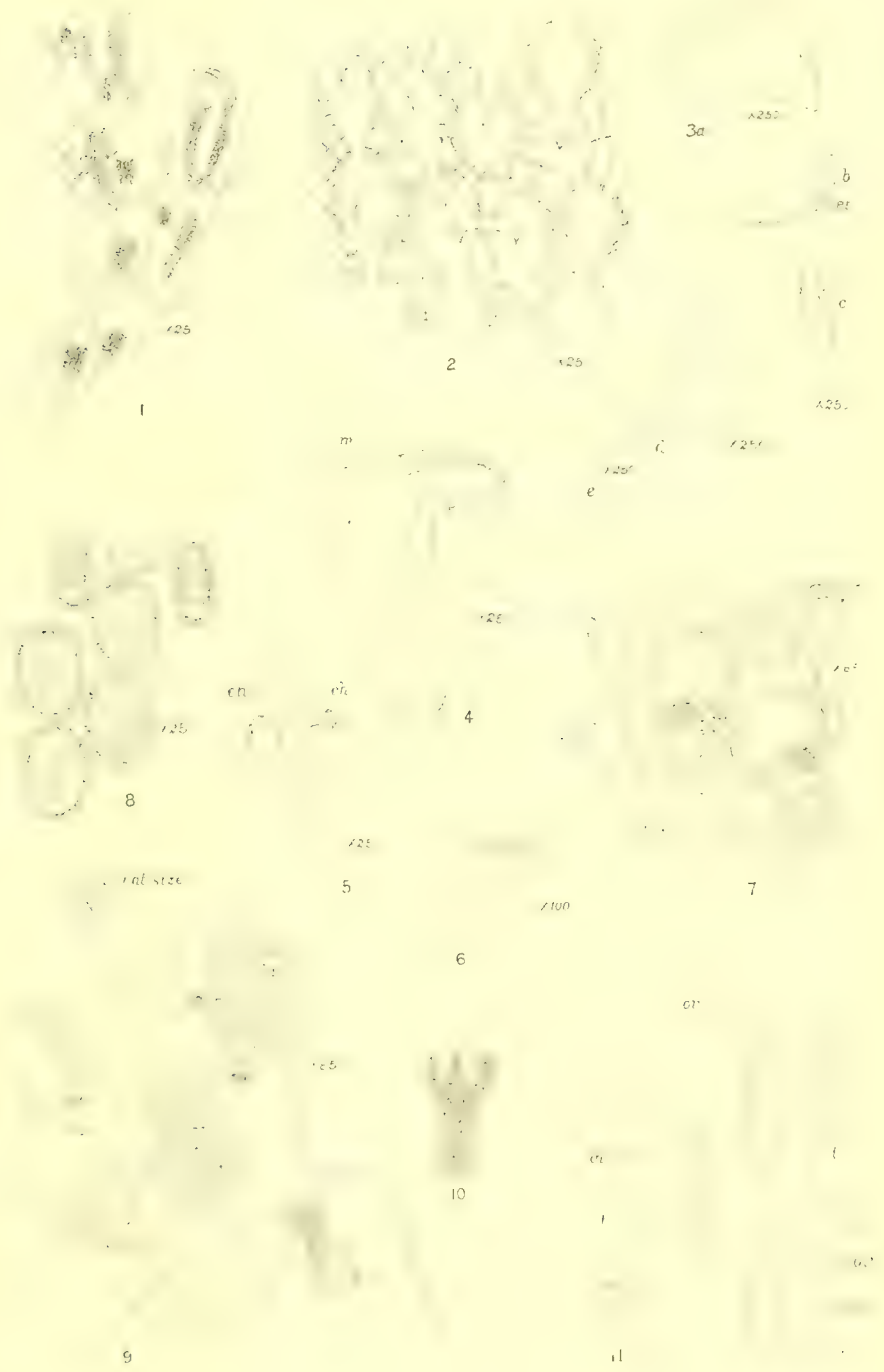
Fig. 6. *Scrupocellaria Macandrei.* Avicularium, × 100.
7. Do. do. × 85.
8. *Membranipora quadricornuta,* sp. nov., × 25. The distal spines usually stand erect, but some are given bent down to show the shape.
9. *Scrupocellaria tridentata,* sp. nov., × 85.
10. Do. do. Mandible fitting into the avicularium.
11. *Scrupocellaria Macandrei,* × 85. Decalcified, showing the position of the ovary (*ov.*) and the testes (*t.*).

Plate 2.

Fig. 1. *Schizoporella trichotoma,* sp. nov., × 50.
2. Do. do. × 85. Operculum.
3. Do. do. × 250. Pores in decalcified membranes of the frontal surface of the zoœcia, showing the larger and smaller rings on the inner and outer wall.
4. Do. do. × 12. Showing the primary zoœcium.
5. *Schizoporella oligopus,* × 25.
6. Do. do. × 25. Dorsal surface.
7. *Holoporella pusilla,* × 25.
8. Do. do. × 85. Operculum.
9. Do. do. × 85. Mandible.
10. *Schizoporella spongites,* × 25. Showing ovicell and vicarious avicularium.
11. Do. do. × 85. Showing the oral denticles from the front.
12. Do. do. × 85. Oral aperture showing the denticles from the interior.
13. Do. do. × 85. Operculum. From Manaar.
14. *Schizoporella unicornis,* × 85. (*a*) Operculum in the oral aperture from lower layer with closure and small tubule; (*b*) do., with large tubule; (*c*) do.; (*d*) do., showing connection from the tubule to the distal wall of the zoœcium; (*e*) do., with calcareous covering commencing over the distal part of the operculum.
15. Do. do. × 85. Operculum.
16. Do. do. × 25. Zoœcium with part of the front wall removed, showing the zoœcium of a lower layer in an exactly similar position.
17. Do. do. × 4. Side view of the zoarium, showing the superimposed layers of the zoœcia, with some ovicells.
18. *Schizoporella viridis.* Similar multilateral zoarium, showing the irregular position of the layers. From the Red Sea.
19. *Schizoporella porelliformis,* × 25. Showing walls commencing for the next layer, and these walls crossing over the opercula. From Port Elizabeth, S. Africa.
20. Do. do. × 50.
21. Do. do. × 85. Operculum.
22. *Schizoporella unicornis,* × 85. Abnormal double operculum.

Plate 3.

Fig. 1. *Crisia tubulosa,* × 25.
2. *Crisia vincentensis,* sp. nov., × 25. Showing long ovicell.
3. Do. do. × 85. Oœciostome.



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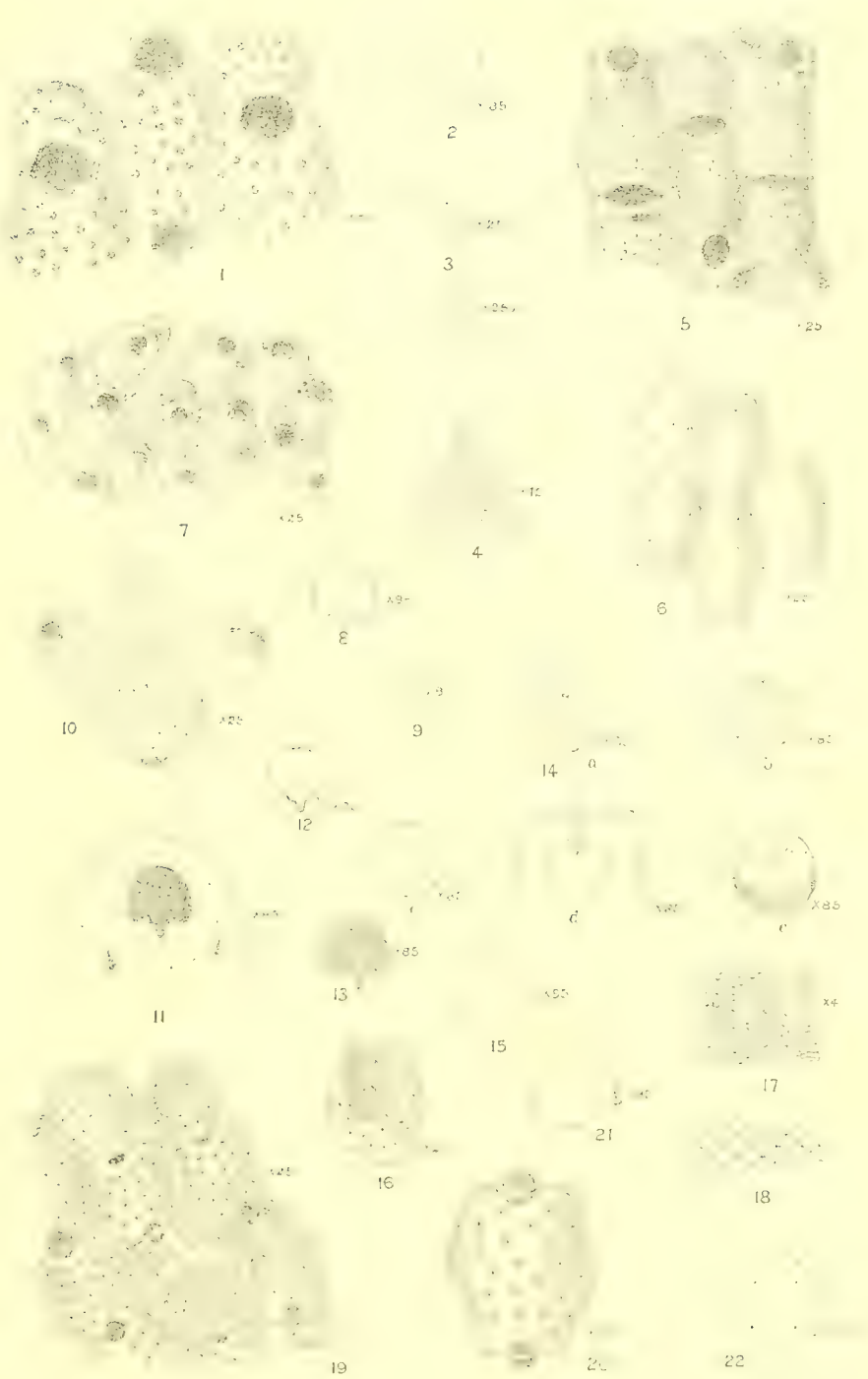

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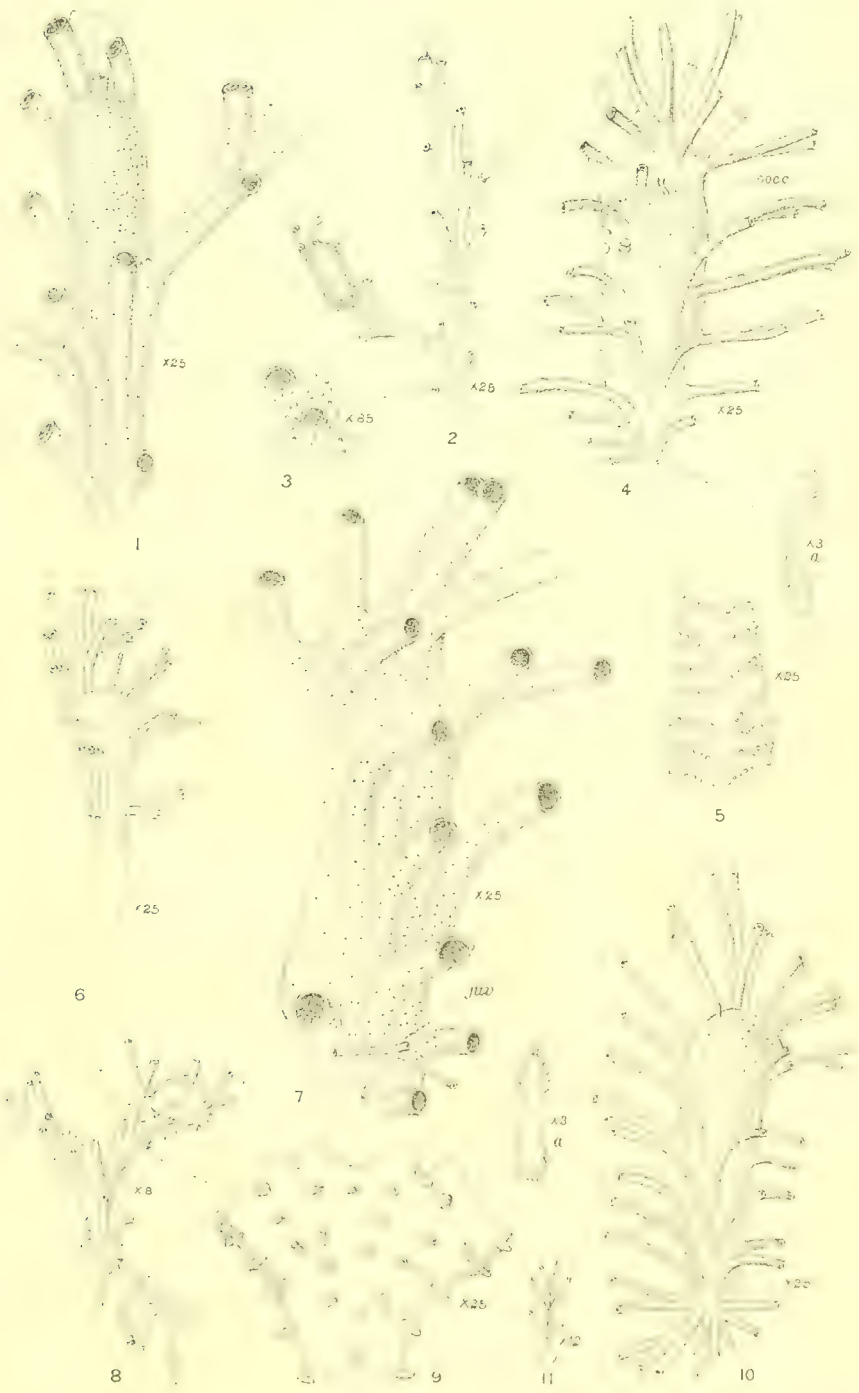

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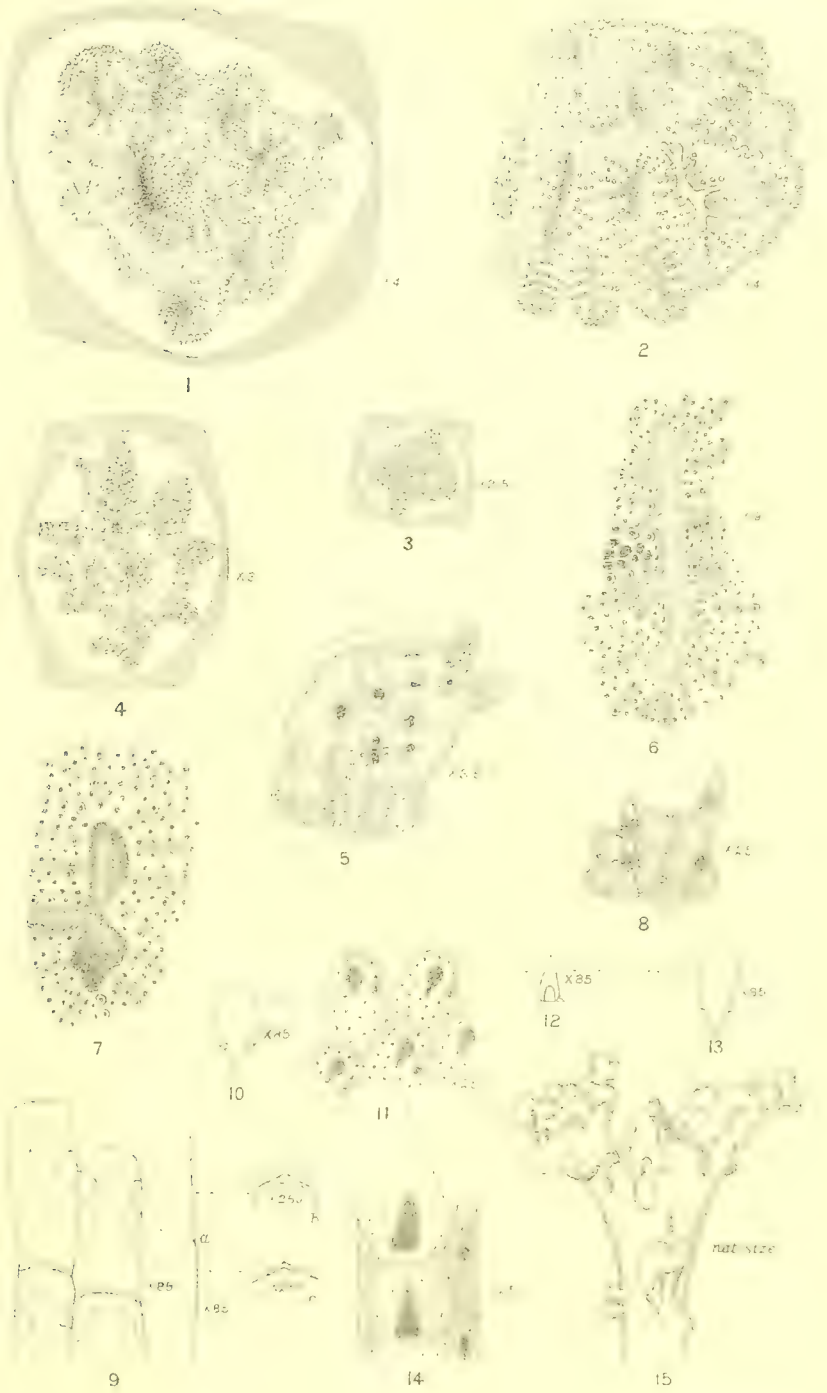

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Fig. 4. *Tubulipora Lamourouxii*, × 25. (*oœc.*) oœciostome. (*a*) × 3.
5. Do. do. × 25. Dorsal surface of fig. 4.
6. Do. do. × 25. The lower part is obscured by *Lithothamnium* growth.
7. *Tubulipora incrassata*, × 25. The magnification of this is the same as of figs. 4, 5, 6, 10. (*Juv.*) is the early growth of *T. Lamourouxii*, Aud., and the difference in the size of the zoœcia of the two species is very marked.
8. *Tubulipora pulchra*, × 8.
9. Do. do. × 25. Dorsal surface.
10. *Tubulipora Lamourouxii*, × 25. (*a*) × 3.
11. Do. do. × 12. Primary and a few zoœcia.

Plate 4.

Fig. 1. *Lichenopora irregularis*, var. *composita*, var. nov. This form is bi-multiserial, × about 4.
2. *Lichenopora irregularis*, × about 4. This form is uniserial and there are ovicells.
3. Do. do. × 2·5. Small uniserial colony.
4. *Lichenopora irregularis*, var. *composita*, var. nov. Uniserial form showing the elongate extension of the subcolonies.
5. *Lichenopora irregularis*, × 3·5. Ovicells showing several pits.
6. Do. do. Ovicell of fig. 2, more magnified.
7. Do. do. Showing pit at the base of which the upper wall of an ovicell is seen, proving the existence of a subcolony at a lower level.
8. Do. do. × 25. Zoœcia showing the spinous elevation surrounded by cancelli.
9. *Thalamoporella Rozierii*, × 25. Dorsal surface, showing through the walls bundles of spicules near the opesiules. (*a*) Spicule nearly straight, × 85; (*b*) spicule "curve," × 250; (*c*) bent spicule, × 250. It should be noticed that the last two are more magnified than (*a*).
10. *Adeonella contorta*, × 85. Aperture.
11. Do. do. × 25. Zoœcia near growing end.
12. Do. do. × 85. Mandible.
13. Do. do. × 25. Operculum.
14. Do. do. × 25. Lateral view, showing large vicarious avicularia.
15. Do. do. Natural size.